SOCIAL INTERDEPENDENCE THEORY IN SPORT

by

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ABSTRACT

This thesis investigates examining the effects of certain types of interdependence on motor performance in competition. In the first experiment, participants undertook a ball carrying and running task under varying levels of between-team resource interdependent condition in the individual competition. The number of balls that carried to the container decreased when between-team resource interdependence exists. In the second experiment, participants completed a basketball shooting and rebounding task under varying levels of between-team resource interdependent condition in a two-on-two team competition. Results indicated that the number of baskets made, the number of baskets attempted and the shooting accuracy was higher in resource independent competition. In the third experiment, participants undertook the same basketball shooting and rebounding task as the second experiment under varying levels of between-team resource interdependent condition and within-team reward interdependent condition. Results indicated effort-based performance was greater under resource independent condition and its interaction with low reward interdependent condition. In the final experiment, participants undertook a handgrip task in a four-on-four team competition. Compared to the no reward condition, performance was better under both high reward interdependent condition and low reward interdependent condition. Mediation analyses revealed that positive emotions, self-reported effort and pressure mediated the change of performance.

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Chapter 1: General Introduction

Competition is a social process that is relevant to everyone's lives, and none can escape it (Martens, 1975). To find out how an individual could get more benefits from competition, hundreds of studies have been conducted on the effects of competition in education (e.g. Deutsch, 1949), business (e.g. Ghemawat, 2002), and sport (e.g. Stanne, Johnson, & Johnson, 1999). However, when we use the word "competition," it might not exactly refer to the same meaning for everyone.

Martens (1975) defined competition as one form of social evaluation, which progresses in four stages that are linked to each other: the objective competitive situation, the subjective competitive situation, the response, and the consequences of the response. Specifically, the objective competitive situation could refer to a social environment with social evaluation and social comparison, in which an individual's performance is in comparison with some standards. When people are involved in an objective competitive situation, the way how the person evaluated, perceived, and understood the situation is called the subjective competitive situation. Then, the person must decide to face or avoid the perceived subjective competitive situation by physically, psychologically, and behaviorally responding to the situation. Finally, the effects of the response would lead to a consequence, which is usually compared to a standard, such as previous physical and psychological performance and an opponent's physical and psychological performance. There have been many studies looking at the different stage of this progress, and many theories have been conducted explaining the relationship between these stages. To investigate the competition-performance relationship, several studies have looked at either the effects of different subjective competitive situation, e.g. task and ego orientation (e.g. Duda, 1989), challenge and

threat state (e.g. Moore, Vine, Wilson, & Freeman, 2012), and intrinsic motivation (e.g. Ryan & Deci, 2000) or the effects of different responses, e.g. enjoyment (e.g. Cooke, Kavussanu, McIntyre, & Ring, 2011), anxiety (e.g. Wilson, Smith, Chattington, Ford, & Marple-Horvat, 2006), and effort (e.g. Cooke et al., 2013). However, due to the varieties of competitive tasks, few studies have focused on clarifying the different objective competitive situation (Stanne et al., 1999), which formed different types of competition. Therefore, it is worthwhile to have a theoretical analysis and conceptual clarification on competition to get a better understanding of the nature of competition and its relationship with the consequences. Next, an overview of the effects of competition on sports performance is provided. In the subsequent sections, social interdependence theory is reviewed to provide a possible approach to clarify different types of competition, and a better explanation of the effects of competition on sports performance.

Effects of Competition on Motor Performance

The effects of competition on motor performance have been studied over one hundred years. The most widely recognized early research was Triplett's (1898) study on cyclists' racing performance. He found that cyclists rode faster in the one-on-one competition than doing the same task individually. It was the first published work on comparing the motor performance between competition and individualistically condition. Since his work, hundreds of studies have investigated the effects of competition on motor performance by comparing performance under different task conditions (e.g. competition vs. cooperation, competition vs. individualistically condition, one-on-one competition vs. group competition).

In Martens's (1975) review, more than twenty-five studies that looked at the effects of competition on motor performance were included. He concluded that

competition could improve performance on muscular endurance and strength tasks, as well as tasks with well-learned and simple skills. In contrast, competition tended to have adverse effects on complex tasks or tasks not well learned, which indicated that the initial ability might play an important role in determining the effects of competition on performance. Moreover, he argued that the mediators of the effects of competition on performance and the relationship between stress and performance under competition were still unclear due to the inadequate number of competition research on motor performance. At the end of his study, he emphasized the need of wide-scale study on both the determinates and the consequences of competition on better understanding the effects of competition.

In 1999, Stanne and his colleagues reviewed sixty-four studies that looked at the effects of competition on motor performance. They found that people's motor performance was better under competition than the individualistic condition. However, cooperation was considered to result in higher motor performance than the competition in their meta-analysis. They argued that compared to cooperation, a better motor performance in the competition was only found on the type of task which must be simple and so overlearned. In line with Marten's statement, it seems that the type of task or the ability to complete the task was likely to influence the effects of competition on motor performance. In their review, they also classified previous studies as belonging to one of three types of competitions: zero-sum competition, appropriate competition, and unclear competition. Zero-sum competition happens when one person can only achieve his or her goal while others failed to do so. Appropriate competition occurs when the following conditions are fulfilled: winning is relatively unimportant, every participant has a reasonable chance to win, the rules are clear, the procedure or the progress can be monitored by each other. All other

types of competition that excluded from the former two types are unclear competition. However, as they mentioned in their study, these three types of competition were not clearly independent. Except that, the appropriate competition was not likely to happen in a real sports environment, and the team competition was a combination of cooperation and competition instead of competition (Tauer & Harackiewicz, 2004). Accordingly, the three types of competition in their review were not an ideal way to clarify competition. Stanne et al., (1999) also asserted in their study that the variety of the definition among researchers might cloud the understanding of the effects of competition on motor performance, which rose the need to clarify different types of competition systematically.

In 2012, Murayama and Elliot included over one hundred studies that looked at competition-performance in their review and found no noteworthy relation between competition and performance. A criticism of the utility of this review was the definition of the types of competition and the clarity of the control condition. In their study, they categorized competition into three types: trait competition, perceived competition and structure competition. Trait competition was defined as “a dispositional preference to compete with others in achievement situation” (Murayama & Elliot, 2012, p.1036). Perceived competition was defined as “the cognitive construal of the competitive nature of the achievement setting” (Murayama & Elliot, 2012, p.1036). Structure competition was defined as “an actual situation in which two or more people vie for a mutually exclusive achievement outcome” (Murayama & Elliot, 2012, p.1036). However, according to Martens's (1975) explanation of the progress of competition, the structure competition was similar to the objective competitive situation, while trait competition and perceived competition were similar to the subjective competitive situation. In other words, they grouped studies more

likely by different stages of the competition, and it seems these three types of competition were not really independent. Johnson, Johnson, and Roseth (2012) noted that Murayama and Elliot (2012) seemed to group the studies included in their review by the operational definition of competition, thus their study was not looking at the effects of three different types of competition on performance.

In sum, the effects of competition on motor performance have been observed in hundreds of studies (Martens, 1975; Stanne et al., 1999). Some researchers found it improved motor performance (e.g. Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011) while others not (e.g. van de Pol P, Kavussanu, & Ring, 2012). relatively few studies have focused on the conditions or the structure of the tasks under which competition could be constructive or destructive. Previous reviews of the literature that looked at the effects of competition on motor performance either assumed that all competition is the same or failed to clarify different types of competition clearly.

Johnson, Johnson, and Roseth (2012) declared that competition could be understood through the relational approach, in which competition is something that exists and can only be discovered by observing its effects. Social interdependence theory was a successful example of applying the relational approach to competition, whereas it has not been widely used for investigating the effects of competition on sports performance. As a consequence, social interdependence theory was outlined next and adopted to clarify different competition in the experiments that are described later in this thesis.

Social Interdependence Theory

Social interdependence exists when people share common goals, and each individual's outcome is affected by the actions of others (D W Johnson, 1999; D W Johnson & Johnson, 2005), it reflects the way how different people may be

interrelated. Different types and levels of social interdependence can be identified in different tasks, which provides an approach to clarify different types of competition. Moreover, by investigating the influence of varied social interdependence in competition, it could lead to a better understanding and a clearer explanation of the effects of competition on motor performance.

Nature of Social Interdependence Theory

The historical roots of social interdependent theory can be traced to the 1900s, when Koffka (1935) suggested that groups can be treated as dynamic wholes in which the interdependence among group members can be different. Building on this principle, Lewin (1935, 1948) then proposed that the nature of a group was the interdependence among group members, which made the group a dynamic whole, whereby any changes in one group member would affect other group members. Deutsch (1949) extended Lewin's theory by identifying how different group members are irrelated inside the group or between groups. The basic premise of social interdependence theory is that the structure of the goal can affect the way how individuals interact, and the interaction pattern can affect the consequence of the task (Stanne et al., 1999).

In Deutsch's (1949) study, he categorized social interdependence into three types, positive interdependence, negative interdependence, and no interdependence. Positive interdependence existed when individuals perceived that they could reach their goals when other individuals can also reach their goals at the same time. Negative interdependence exists when individuals perceive that they can reach their goals when other individuals failed to reach their goals. No interdependence exists when individuals perceive that they can reach their goals regardless others can reach their goals or not. With the increasing number of research studies on social

interdependence theory, various researchers have structured social interdependence according to the elements in the task, such as the division of labour, the distribution method of reward, environmental space, identity within and between the group (D. W. Johnson & Johnson, 2009). These ways of structuring roughly categorized social interdependence into three categories: outcome interdependence, means interdependence and boundary interdependence, through which the structure of the task can be understood better (D W Johnson, 1999; D. W. Johnson & Johnson, 2009; Tjosvold, Johnson, Johnson, & Sun, 2006). Also, Evans, Eys, and Bruner (2012) suggested that in a sports environment, social interdependence always exist on both team level (between-team) and individual level (within-team). However, there was little attention on further classify the interdependence for individual-level and group-level outcomes or resources.

Outcome Interdependence

Outcome interdependence can be defined as the degree to which the significant outcome that one individual obtained depend on the actions of others. It can be further subsumed into goals interdependence and reward interdependence.

Goals interdependence. Positive goals interdependence is a basic element of cooperation, and its effects on increasing achievement, interpersonal attraction, social support, self-esteem, and productivity have been observed in many studies (D W Johnson, 1999; D W Johnson & Johnson, 2005; Roseth, Johnson, & Johnson, 2008; Stanne et al., 1999; Tauer & Harackiewicz, 2004; Tjosvold, XueHuang, Johnson, & Johnson, 2008). When individuals perceived positive goals interdependence, they were aware of that their performance would affect the success of the team, which seems to create responsibilities that force people to contribute more effort into the task (D W Johnson & Johnson, 2005). Moreover, when people realized that their

effort was required for the team, free-riding was not likely to occur, which prevents the deduction on the contribution of the team members (DeMatteo, Eby, & Sundstrom, 1998; Kerr & Bruun, 1983).

Negative goals interdependence is a basic element of competition. Both positive goals interdependence and negative goals independence can exist at the same time in the team competition, where within-team goals interdependence was positive and between-team goals interdependence was negative, such as a soccer game. Cooke and his colleagues (2013) found that individuals' performance was better in team competition where both positive and negative social interdependence existed than individual competition where no positive goals interdependence was involved. In their study, they found the improvement of performance from individual competition to team competition was mediated by the change on enjoyment. It might be worth to find out whether the change of enjoyment was a result of the positive goals interdependence.

Reward interdependence. Reward interdependence can be defined as the extent to which the reward an individual can get depends on the performance of others (D W Johnson & Johnson, 2005). Positive reward interdependence is always dependent on positive goal interdependence, such as the winning bonus for a football team. Whereas negative reward interdependence always exists with negative goals interdependence, such as the gold belt in a boxing match. Despite this, in the team competition, reward interdependence can be both positive and negative at the same time, such as the tournament prize for the winner of a football league. According to the extent to which the reward would be distributed based on their performance within the team, it can be categorized as low reward interdependence (or reward independence) and high reward interdependence. Low reward interdependence is one

given to everyone regardless of their performance, such as appearance money. High reward interdependence, by contrast, is one given to individuals based completely on their performance in the group, such as performance related pay (Wageman, 1995).

DeMatteo et al., (1998) concluded from their review that low reward interdependence (equal distribution of team rewards) tends to increase cohesion and solidarity within the team, whereas high reward interdependence (differential allocation based on individual performance within the team) was likely to push team performance to the highest level. They argued that the way how people reacted to the different levels of reward interdependence was associated with the perceived fairness of reward allocation in the circumstance they confront (Deutsch, 1975; Leventhal & Cupchik, 1976). According to Leventhal and Cupchik's (1976) judgment model, individuals tend to use objective information that they perceived from the environment, or the feeling they obtained confronting the situation to construct judgment and behaviour. Morton Deutsch (1985) stated that when people believed that maintaining social harmony is important to the group, the low reward interdependence might be a fair allocation to keep solidarity or cohesion among team members. Therefore, based on the existing research, DeMatteo et al., (1998) suggested that low reward interdependence was more likely to promote cooperative behaviour while high reward interdependence was likely to improve team productivity.

Fan and Gruenfeld (1998) proposed that high reward interdependence could improve group performance by creating common fate in the group, which could lead to facilitative behaviours and reduce blocking behaviours. However, high reward interdependence was likely to decrease individual effort by reducing individual autonomy and outcome control (McClelland, 1980). Moreover, high reward

interdependence might result in social loafing and free-riding due to the limitation on individual's ability to affect outcomes directly, and the difficulty to have people's contribution recognized and valued (Price, 1987; Weldon & Mustari, 1988), which tends to adversely impact the team effort.

In addition, many studies have looked at the interaction between different types of social interdependence. Ortiz, Johnson, and Johnson (1996) suggested that the combination of positive goal and reward interdependence within the team tends to foster achievement more than the positive goal interdependence alone. In Courtright and his colleagues' (2015) study, they found task interdependence and outcome interdependence were both critical inputs for the effectiveness of the team in different paths. In their meta-analysis path model, task interdependence was found have influence on team performance mainly through task-focused team process, i.e. transition and action, while outcome interdependence affected team performance mainly through interpersonal process.

Wageman and Baker's (1997) study assessed the effects of task interdependence and reward interdependence in their article error correction study. The percentage of the errors that an individual could find out from the article given to him or her without his / her partner's knowledge was varied from 50%, 66%, to 100%, which manipulated the low, moderate, and high task interdependence. Different levels of reward interdependence were manipulated by the percentage of reward an individual could get from each error he/she found out; it varied from 50%, 70% to 100%, the rest of the reward was given to his / her partner. Their results suggested that, compared to the low reward interdependence, participants performed better when the reward interdependence was high, while there was no effect of task interdependence on performance.

Allen, Sargent, and Bradley (2003) did a similar article error correction study with a larger group size and found no significant effects of either task interdependence nor reward interdependence on performance. They argued the positive effects of high task interdependence and high reward interdependence on performance tends to occur where the task was less complicated, and people's average ability was relatively high. Moser and Wodzicki (2007) stated that, when the task interdependence was high, it might create ceiling effects to prevent high reward interdependence from being an extra incentive because the reward can only be obtained when people shared their resources, completed their own tasks, and cooperated well. In contrast, when the task interdependence was low, people might not be motivated to share their knowledge or help other group members, so high reward interdependence cannot act as an additional incentive for cooperation as well.

Means Interdependence

Means interdependence includes resource, role, and task interdependence, which are overlapping and not independent of each other (D W Johnson & Johnson, 2005). It can be defined as the degree in which people required others' resources, others' roles and the completion of others' tasks to complete their own tasks. Many researchers had found that when no means interdependence exists in the task, competition could induce greater productivity than cooperation (D W Johnson & Johnson, 1989; Stanne et al., 1999). On the other hand, some studies suggested that when means interdependence exists in the task, cooperation promoted greater productivity than competition and individualistic condition (Stanne et al., 1999). Because of the dependent relationship between role and task interdependence, role interdependence was considered independently in the following sections.

Resource interdependence. Resource interdependence can be defined as the extent in which resource that each individual controlled to complete the task was affected by other's actions. It can be identified between-team and within-team. When resource interdependence was high between teams, people must fight for resources that needed to achieve the goal, such as the paint zone area on a basketball court. When resource interdependence was low between teams, all the teams could complete the task without the requirement of others' resources, such as team swimming. Furthermore, when resource interdependence was high within the team, people must pool their resources to achieve the goal, such as the playing time in a basketball game. Whereas the low resource interdependence or resource independent exist when each individual can accomplish the task without the requirement of any other's resources, such as gymnastics (Fan & Gruenfeld, 1998).

Gruenfeld (1995) suggested that when resource interdependence was high within the team, people tend to interact more through asking and negotiating required resources, which might help people to recognize multiple strategies and viewpoints, and were likely to result in a better understanding of the task. Maier (1970) also proposed that, with a higher level of interaction within the group, individuals might be benefit more from information exchange and helping behaviours (Fan & Gruenfeld, 1998; David W Johnson, 1974), through which high resource interdependence might help individuals to accomplish the task more effectively.

From a different perspective, high resource interdependence tends to result in process losses (Johnson & Johnson, 2005) and performance deficits (Fan & Gruenfeld, 1998). Fan and Gruenfeld (1998) argued that when there was more interaction in the group, individuals must contribute more attention to organize and order individual inputs, which might reduce the amount of attention on the task itself.

Moreover, Ortiz, Johnson, and Johnson, (1996) stated that high resource interdependence might decrease achievement and productivity when people required the resources of other group members with alternative goals, which may lead to a situation where people tend to obtain resources from others without sharing their own resources with them. It seems that the effects of resource interdependence were depend on the goals interdependence in the task (Evans et al., 2012).

Ortiz and his colleagues (1996) investigated the interaction between goals interdependence and resource interdependence in their learning and quiz answering study. They found that participants in the combination of positive goals and resource interdependence group performed best compared to other groups (positive goal interdependence, positive resource interdependence, and no interdependence). They suggested that the improvement effects of positive goals interdependence on performance was boosted by the additive relationship between positive goal interdependence and resource interdependence.

Task interdependence. Task interdependence can be defined as the necessity for individuals to work together to complete the task (Moser & Wodzicki, 2007). High task interdependence is very common in team sports, such as netball, where each team player had his or her own task to complete to accomplish the team goals. Johnson and Johnson (2005) stated that, when task interdependence was high, team members tend to contribute more to develop smooth interpersonal interactions, which resulted in more mutual helpings, greater interpersonal liking and harmony experience. Courtright and his colleagues (2015) suggested that high task interdependence encouraged collaboration within the team as team members had to depend on others' completion of their tasks for the goal accomplishment, which promotes the frequency of interaction between team members. Frequent interactions between team members

have been found to have positive effects, such as improving information sharing, coordination and joint decision making (Gruenfelda, Elizabeth, Katherine, & Neale, 1996; Rockett & Okhuysen, 2002). Also, Rockett and Okhuysen (2002) suggested that when team members interact more and become more familiar with each other, they are more likely to learn and improve their own ability from other team members. As a result, a higher level of task interdependence tends to promote team member's self-confidence regarding accomplishment of the goal by the increased perception on the team's average capability of successfully achieving the goal (Courtright et al., 2015). Furthermore, Hertel, Konradt, and Orlikowski (2004) stated, when the task interdependence was high, people might feel that their personal performance is highly indispensable for the accomplishment of the goal when they performed poorly and perceived that their performance might inhibit the outcome of other team members. This in turn could motivate the person with the bad performance and other team members to contribute additional effort into the task, which resulted in a higher level of effectiveness of the whole team (Hertel, Kerr, & Messé, 2000). On the other hand, when the task interdependence was low, the poor performance of one team member could be compensated by other team members, which might prevent the team from being motivated and even result in social loafing or free-riding (Hertel et al., 2004), and resulted in detrimental effects on team effectiveness.

Boundary Interdependence

Boundary interdependence is used to describe the way in which discontinuity can be created. In other words, it explained the reason of people being grouped (D. W. Johnson & Johnson, 2005; D. W. Johnson & R. T. Johnson, 2009; D.W. Johnson, 1999). Boundaries exist among individuals and groups, which defines who is interdependent with whom (Coleman & Deutsch, 2012). Coleman and Deutsch (2012)

pointed out that boundary interdependence might segregate people into different groups based on the abrupt discontinuities among individuals. The abrupt discontinuity might be a consequence of environment, such as home and away changing rooms, similarity, such as wearing the same colour training bib, proximity, such as seating together in the same area, past interaction history, expectations of being the same group, and differentiation from opponent teams. As a result, boundary interdependence can be identified through a sense of identity, which is consistent with a set of attitudes that define "who you are" and through which individuals could be internally bond together as an entity, environmental closeness, which externally or physically separate a group of people from other groups, and outside enemy, in which negative interdependence exist.

Summary

In sum, social interdependence theory (D W Johnson, 1999; D W Johnson & Johnson, 2005) provides a framework that explains the structure of a task, through which competitive tasks can be categorized into more specific types. Positive and negative goals interdependence both exists in the team competition, positive goals interdependence has been found having effects on encouraging people to put more effort in the task, which might result in a better performance in team competition than cooperation and individual condition. Reward interdependence is an important type of outcome interdependence, which tends to affect performance through interpersonal progress, and its effects are highly depend on the level of task interdependence. A High level of reward interdependence was found likely to improve team productivity by creating common fate in the group, while a low level of reward interdependence was more likely to promote cooperative behaviour by encouraging people to maintain social harmony. High resource interdependence has been found to have effects on

increasing information change and helping behaviour, which tends to increase team performance. The effects of high resource interdependence were depended on the goals interdependence in the task. Furthermore, high task interdependence was found playing a significant role in the improvement of team performance through a higher level of interaction and team motivation.

By identifying different forms of social interdependence in different competitive tasks, it can help us recognize different effects of different tasks and get a clearer understanding of the nature of competition and the effects of it on performance, emotions, and motivation. Many researchers have argued the importance of not viewing interdependence as one variable, but to clearly specify the type of interdependence that was testing in the study, and consider the effects of different types of interdependence on the outcome variables. It could help us have a deeper understanding of the competition-performance relationship.

Limitations of Previous Research

Three general limitations of previous research looking at the effects of different types of competition on motor performance can be described. First, previous studies that specified the types of social interdependence in the task were mostly conducted in the context of education or business (e.g. Allen et al., 2003; Mitchell & Silver, 1990), in which the effects of competition might be different to a sport environment. Due to the limited number of research studies that looked at the effects of different types of interdependence in sports competition, specific types of interdependence need to be investigated in motor tasks.

Second, previous research has not looked at the effects of between-team resource interdependence in team competition, which is very common in sport, such as basketball, soccer and hockey. As mentioned above, an improved sports

classification is essential for researchers to understand the nature of the sports environment. A better understanding of the effects of between-team resource interdependence could offer a glimpse of the nature of different sports environments.

Third, previous studies have documented the psychological (e.g. enjoyment) and behavioural (e.g. errors corrected in the article) changes in competition. Only a few studies (Cooke et al., 2013; Cooke, Kavussanu, McIntyre, & Ring, 2011; Tauer & Harackiewicz, 2004) have examined whether the change in performance was caused by these changes. However, these studies have not identified the interdependence in the task and thereby did not consider interdependence as a mediator of the psychological and behavioural changes, which might affect the interpretation and implication of the effects of competition. The use of mediation analysis could provide a stronger prediction between variables.

Aside from these general limitations, there are also specific limitations that relate to the individual elements of various experiments, which are covered in the introductions of each of the following four experimental chapters.

Aims of Thesis and Outline of Experimental Chapters

With the goal of improving our understanding of the social psychology of competition, this thesis investigates the effects of certain kinds of interdependence that might induce the change in performance under competition. The primary purpose was to assess the effects of between-team resource interdependence, within-team high and low reward interdependence on people's motor performance, emotions and effort. It is hoped that by clarifying the effects of different types of interdependence, researchers, athletes, coaches, and practitioners can obtain a better understanding of how individuals feel and perform in different sports environment, and then develop targeted intervention strategies to motive individuals to involve and maintain a high

level of performance. The following experimental work is novel as it represents the first set of experiments to systematically identify the effects of different types of social interdependence on sports competition. Despite this, it also examined the mediation effects of social interdependence and possible variables that have been found to predict changes in motor performance.

The experiment reported in chapter two was designed to test the effects of between-team resource interdependence in a one-on-one effort-based motor task. The primary aim was to investigate the difference in motor performance, emotions, and effort between resource interdependent condition and resource independent condition. A ball carrying and running task was employed. It was expected that participants would perform better under resource independent condition.

The experiment presented in chapter three examined the effects of between-team resource interdependence in a two-on-two effort and skill mixed based task across three different level of fairness of competition (advantageous, fair and disadvantageous). By using a team competition, the study was designed to examine whether the effects of between-team resource interdependence was different between individual and team competitions. This design was based on the suggestion that individuals performed differently between individual and team competitions (e.g. Tauer & Harackiewicz, 2004). By manipulating different levels of the fairness of competition, the study was designed to find out whether the psychological changes induced by the various fairness of competition was associated with changes in motor performance. This was based on the suggestion that fairness of competition was an important element to group competition (e.g. Stanne et al., 1999). Again, the primary aim was to investigate the difference in motor performance, emotions and effort between a resource interdependent condition and a resource independent condition.

The secondary aim was to assess the effects of fairness of competition on motor performance, emotions, and effort, and evaluate the possible mediation effects of emotions and effort on performance. A basketball shooting and rebounding task was employed in the task. It was expected that participants would attempt and made more baskets under resource independent condition, and the shooting accuracy might be similar between resource interdependent condition and resource independent condition.

To examine the effects of high and low reward interdependence, the experiment reported in chapter four was designed to investigate the effects of between-team resource interdependence and within-group reward interdependence in a two-on-two effort and skill mixed based task. By using a basketball shooting and rebounding task, the amount of task interdependence was high, so that the interaction effects between task interdependence and reward interdependence can be observed. This was based on the suggestion that the effects of reward interdependence were largely depend on the level of task interdependence (e.g. Moser & Wodzicki, 2007). The primary aim was to further investigate the differences in motor performance, emotions, and effort between a resource interdependent condition and a resource independent condition. The secondary aim was to assess the effects of high and low reward interdependence on motor performance, emotions, and effort in a high task interdependent condition. The same basketball shooting and rebounding task as was used in the previous experiment was employed. It was expected that compared to the low reward interdependent condition, the high reward interdependent condition would increase the effort-based performance, such as the number of baskets attempted.

Finally, the experiment presented in chapter five examined the effects of within-team reward interdependence in a four-on-four effort-based task. This

experiment was designed to further investigate the effects of high reward interdependence on effort-based motor performance. By using the handgrip task, the level of skills that required to complete the task was minimized. It was based on the suggestion that when the task interdependence was high, the large gap between the task complexity and the average skill level to complete the task would prevent high reward interdependence from promoting the performance (e.g. Allen et al., 2003). Again, the primary aim was to assess the effects of high and low reward interdependence on motor performance, emotions, and effort in low task interdependent condition and further investigate the mediation effects of emotions and effort on motor performance. A handgrip task was employed, with the total percentage of participants' maximal voluntary contraction serving as the measure of performance. It was expected that compared to the low reward interdependent condition, participants would perform better in the high reward interdependent condition with a higher level of self-reported effort.

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Chapter 2: The Effects of Between-Team Resource Interdependence in An Effort-Based Task

Abstract

Competition is very common in a sports environment. However, the classification of different types of competition is still unclear. Social interdependence theory provides a framework that explains the way a task is structured. By identifying the effects of particular type of interdependence, it can lead to a better way to clarify different types of competition and a better understanding of the nature of competition. The current experiment examined the effects of between-team resource interdependence in a one-on-one effort-based motor task to investigate the effects of between-team resource interdependence on motor performance, The difference in motor performance, emotions, effort and goal-related perceptions between resource interdependent condition and resource independent condition were examined in 8 males and 6 females during a ball carrying and running task. Results indicated that compared to the resource independent condition, participants carried a lower number of balls to the container under resource interdependent condition. Except that, there were no main effects of resource interdependence on emotions, effort and goal-related perceptions. These findings extended the understanding of the effects of social interdependence on explaining the change of performance in different situations.

Introduction

During the past 160 years, although hundreds of studies have been conducted about the effects of competition, the definition of competition is still unclear. Due to the complexity of the competition process which has been found associated with emotion (e.g. Cooke, Kavussanu, McIntyre, & Ring, 2013), motivation (e.g. Duda, Chi, Newton, Walling, & Et Al, 1995), personality (e.g. Franken & Brown, 1995), social environment (e.g. Johnson, 1999) and the like, it is impossible to fully understand the nature of competition without a clear definition and clarification. According to the definition used by Deutsch (1949, 1968), competition is the situation in which people's goals are negatively correlated. Skinner (1968) defined competition as a situation in which only the person who achieves the best in comparison with others can be given a reward. Besides, it has been well documented that the effects of competition depend largely on the structure of the task (Tauer & Harackiewicz, 2004). In other words, different task structures might induce different types of competition.

Social Interdependence Theory

Social interdependence is very common in people's lives. It exists when individuals share common goals, and each individual's results can be influenced by others' actions (D. W. Johnson & Johnson, 2005; D.W. Johnson, 1999). It can be roughly categorized by positive interdependence and negative interdependence (Johnson & Johnson, 2005). Positive interdependence, such as mutual support, exchange of needed resources and trust, tends to induce and be induced by cooperation. Similarly, negative interdependence such as interruptions of each other's process, deceptive communication and striving to occupy the needed resource, tends to induce or be induced by competition. More specifically, interdependence can be

theoretically classified as outcome interdependence, boundary interdependence and means interdependence (Johnson, 1999).

Outcome interdependence is defined as the extent to which an individual's goals and rewards can be obtained depending on whether others can achieve the target successfully or not. Johnson and Johnson (2005) concluded from their review that positive goals interdependence, which induced cooperation, has positive effects in terms of increasing achievement, interpersonal attraction, social support, self-esteem, and productivity in many studies. They suggested that positive interdependence did not simply motivate individuals to try harder, because of the enhanced interaction among team members, it helped people to discover and develop a more effective strategy to complete the task (D. W. Johnson & Johnson, 2005; D.W. Johnson, 1999). In contrast, negative goals interdependence, which was viewed as a basic element of competition, has shown both positive (Cooke et al., 2013; Tauer & Harackiewicz, 1999, 2004) and negative (D. W. Johnson & Johnson, 2005; Stanne et al., 1999) effects on performance in many studies when compared to cooperation.

Boundary interdependence is used to describe the way in which people are grouped. Coleman and Deutsch (2012) pointed out that boundary interdependence might segregate people into different groups based on the abrupt discontinuities among individuals. The abrupt discontinuity might be a consequence of environment, such as home and away changing rooms, similarity, such as wearing the same colour training bib, proximity, such as seating together in the same area, past interaction history, expectations of being the same group, and differentiation from opponent teams.

Means interdependence is defined as the extent to which individuals share roles, resources, and tasks during the activity. Many researchers had found that when

no means interdependence exists in the task, competition could induce greater productivity than cooperation (Johnson & Johnson, 1989; Stanne et al., 1999). On the other hand, some studies suggested that when means interdependence exists in the task, cooperation promoted greater productivity than competition and individualistic condition (Stanne et al., 1999). Resource interdependence is one important type of means interdependence, which can be defined as the extent in which the resource that each individual controlled to complete the task was affected by other's actions. Johnson and Johnson (2005) suggested that resource interdependence by itself might reduce team achievement and productivity. They argued that there tends to be interference on team productivity when team members tend to request others' resources without sharing their own resources with them. Despite this, Gruenfeld (1995) suggested that resource interdependence forced people to interact more through asking and negotiating required resources, which might help people to recognize multiple strategies and viewpoints, and were likely to help individuals accomplish the task more effectively. However, most previous research only tested the effects of resource interdependence in cooperation; there has been little interest paid to the effects of resource interdependence on performance in competition. Therefore, the current study was the first study looking at the effects of between-team resource interdependence in competition.

Task Type and Performance

Many studies have hypothesized that different types of task have different effects on the relationship between social interdependence and productivity (Hackman & Morris, 1975; Stanne et al., 1999). Johnson and Johnson (1989) concluded from their review that the superiority of the effects of positive goals interdependence over negative goals interdependence was greatest in performance combined with skill

learning, and least in performance with a lower level of skills, such as correcting errors in articles. Similarly, an earlier study showed that, if a motor skills task was low means interdependent or means independent, where participants can complete the competition with no or little support from others, competition tended to result in greater achievement than cooperation (Miller & Hamblin, 1963). Jackson and Williams (1985) suggested that competition could promote performance when the task was relatively easy, while the performance could be reduced if the task was complex. Stanne and his colleagues (1999) also stated that the studies in which competitors overperformed cooperators were conducted on simple and overlearned tasks, where the type of task was most likely to result in the difference on performance. They argued that although cooperation could promote people's performance in most conditions, there were certain conditions that competition had better effects on the improvement of performance than cooperation.

Based on the studies reviewed above, tasks can be categorized as efforts based, where the task was relatively simple, easy, and not required learning or developing skills to improve the performance, and skills based, where the task was relatively complex and required learning skills which could lead to a better performance. Effort-based task, such as the power of grabbing, the distance of running and the height of jumping, demand relatively low motor skills (Cooke, Kavussanu, McIntyre, & Ring, 2011). People's performance highly depends on how much effort they put into the task. In contrast, skills-based tasks, such as free throw shooting, golf putting, and football passing, requires more skills to complete the task. Although putting the effort in the task is still a factor that could affect individuals' performance, the quality of the skills they perform may have a more crucial influence on the outcome of the task. Therefore, to obtain a better understanding of the

competition-performance relationship, it is essential to clarify the effects of different types of tasks, which might lead to a better way to explain and interpret the effects of competition on performance (Martens, 1975).

Goal-Related Perception and Performance

Before a competition, individuals may perceive the upcoming competition as either a challenge or a threat, which might result in different feeling and responding in the competition (Jones et al., 2009). According to the biopsychosocial model, challenge and threat occur in the goal-relevant environment (Blascovich, Mendes, Hunter, & Salomon, 1999; Tomaka, Blascovich, Kelsey, & Leitten, 1993). A challenge state was experienced when individuals perceived that they have sufficient or nearly sufficient resources to meet the demands of the perceived situation, while the threat state occurred when individuals perceived that they have insufficient resources to meet the demands of the perceived situation. Therefore, demand and resource appraisal was an important component of the model. Specifically, demand appraisals include the perceived danger, uncertainty, required skill and effort for the accomplishment of the goal. Resource appraisals were associated with the individual's skill level, previous experience, knowledge of opponents, self-esteem, available external support and the like.

Moore, Vine, Wilson, and Freeman (2012) found that participants performed better in a golf putting task in a challenge state than in a threat state. In their study, 127 undergraduates were randomly divided into two groups, the challenge group, and the threat group. All participants were asked to perform six straight putts from three locations to a hole. They found that the challenge group showed a higher accuracy of putting and lower level of perceived anxiety than the threat group. By demonstrating the direct effects of challenge and threat states on motor performance, their study

extended Blascovich and his colleagues' findings (2004), in which college baseball and softball players who experienced challenge state when giving the sport related speech prior to the season, performed better in the subsequent season than the one who experienced threat state. However, very few studies have investigated the effects of challenge and threat states on performance during the task. Therefore, the current study will assess challenge and threat states during the competition to have a better understanding of its effects on different stages and situations of the task.

Emotions and Performance

Competition can be viewed as a source of challenge (Tauer & Harackiewicz, 2004) and at the same time, a source of pressure (Cooke, Kavussanu, McIntyre, & Ring, 2011). Individuals might experience different emotions during competition. For instance, enjoyment, a positive emotion which have been studied in previous research and showed a positive effect on performance (Cooke et al., 2013; Cooke, Kavussanu, McIntyre, & Ring, 2011; Tauer & Harackiewicz, 2004), and anxiety, a negative emotion that have been observed in many studies and showed both positive and negative effect on performance (Cooke et al., 2013; Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011; Cooke et al., 2010; Wilson et al., 2009; Wilson et al., 2006). Processing efficiency theory has been widely studied and used to explain the relationship between anxiety and performance (Eysenck & Calvo, 1992), in which increased anxiety could influence performance in two ways. Firstly, it can reduce performance by the disruption in attentional control. Secondly, it can help individuals maintain performance by allocating additional effort to the task to compensate the negative effects.

Wilson and his colleagues (2009) reported negative effects of anxiety in their basketball free throw shooting task, where shooting accuracy and gaze behaviour was

reduced when participants experienced more anxiety. Cooke and his colleagues (2013) found that individuals obtained better performance and a higher level of anxiety in competition than the individual condition. They also reported that increased anxiety partially mediated the difference in effort, which has been found fully mediated the change of performance between different conditions. Tauer and Harackiewicz (2004) conducted four field experiments with a skill-based basketball free throw task. They found that enjoyment and basketball shooting performance was increased in competition. Moreover, the increased enjoyment was found partially responsible for the promotion of performance.

In the previous studies, emotions have been mostly assessed pre-competition and post-competition, or by long-range retrospective accounts of the best or the worst emotions that experienced during the task (Vast et al., 2010). Very few studies have investigated emotions that occur during competition. As such, the present study explored emotions that participants might experience during competition to get a better understanding of the effects of emotion, and the emotion-performance relationship.

Present Study

The current study was conducted using an effort-based task, in which negative goals interdependence tend to have a positive effect on promoting people's performance. The first aim of the present study was to investigate the effects of between-team resource interdependence on performance, emotions, effort, and goal-related perceptions. It was hypothesized that performance would be worse in the resource interdependent competition (D. W. Johnson & Johnson, 2005). Also, participants were expected to experience more positive emotions in the resource interdependent competition (D. W. Johnson & Johnson, 2005; D.W. Johnson, 1999).

The second aim was to assess the relations among performance, emotions, effort, and goal-related perceptions.

Method

Participants

Fourteen participants (8 male, mean age, 23.63 years, *SD* = 4.93; 6 female, mean age, 24.67 years, *SD* = 6.38) who were currently playing competitive sports gave informed consent and volunteered to participate in the study, which was approved by the research ethics committee of the University of Birmingham.

Measurements

Task performance. The number of balls was carried to the container recorded and served as the primary measure of performance.

Anxiety. Anxiety was assessed using the Sport Emotion Questionnaire (SEQ, Jones, Lane, & Bray, 2005) and a visual analogue scale (VAS). Five items on the SEQ measured anxiety (e.g., "Nervous", "Anxious"). Participants responded the question "How you feel right now, at this moment…" on a Likert scale with anchors of not at all (0) and extremely (4). The Sport Emotion Questionnaire (SEQ) is a sport-specific measure of pre-competitive emotion to assess anger, anxiety, dejection, excitement, and happiness. The SEQ has also been employed successfully to evaluate recalled emotions in a sport setting and has shown construct validity (Jones, Lane, & Bray, 2005). One item on the VAS consisted of a horizontal dotted line of 142 cm length, measured cognitive anxiety by asking "How worried are you feeling?" (Krane, 1994). Participants were asked to indicate how intensely they felt the emotion at that moment in relation to the upcoming competition. The left hand of the 142 cm horizontal scale was labelled "Not at all", and the right hand end, labelled "Extremely".

Anger. Anger was assessed using the SEQ and VAS. Four items on the SEQ measured anger (e.g., "Annoyed", "Irritated"). One item on the VAS measured anger by asking "Did you feel angry with your opponent?" Participants were asked to indicate how intensely they felt the emotion at that moment in relation to past three minutes of competition.

Effort. In addition to the behavioural measure of effort (number of shots), Effort was assessed using a one item VAS by asking "How much effort did you put in the competition?"

Embarrassment. Embarrassment was assessed using the SEQ and VAS. Five items on the SEQ measured embarrassment (e.g., "Embarrassed", "Uncomfortable"). One item on the VAS measured embarrassment by asking "Did you feel awkward because of your opponent, and want to quit the competition?" Participants were asked to indicate how intensely they felt the emotion at that moment in relation to past three minutes of competition.

Dejection, excitement and happiness. Dejection, excitement and happiness were assessed using the SEQ. Five items on the SEQ measured dejection (e.g., "Unhappy", "Sad"), four items measured excitement (e.g., "Enthusiastic", "Excited"), and four items measured happiness (e.g., "Joyful", "Pleased").

Enjoyment. Enjoyment were assessed using a one item VAS by asking "Did you enjoy the competition?" Participants were asked to indicate how intensely they felt the emotion at that moment in relation to past three minutes of competition.

Goal-related perceptions. The perceived importance of the goal, possibility to reach the goal, demand and resource evaluations were measured using a VAS. Importance of the goal was assessed by asking "How important for you to win the competition?" Possibility to reach the goal was assessed by asking "How likely do

you think you can win the competition?" Demand evaluations were assessed by asking "How demanding do you expect the competition to be?" and resource evaluations were assessed by asking "How able are you to cope with the competition?" (Moore, Vine, Wilson, & Freeman, 2012) Participants were asked to indicate how intensely they felt the emotion at that moment in relation to the upcoming competition.

Experimental Design

The study employed one within-subjects factor, Task Condition, with two levels: resource interdependent and resource independent.

Task

The task required participants to repeatedly carry a ping pong ball (diameter 3.9 cm) to two different containers (diameter 4 cm) in 9 minutes. One container was located 6.93 m away from the starting position, and another container was placed 1 m away from the former container, which was 7 meter away from the starting position. Participants were asked to start by carrying a ball to the nearer container and not to put balls into the same container in a row. The number of balls carried to the container was recorded as a measure of performance. A projector was used to show the time and scores on the screen.

Task Conditions

Resource interdependent competition. In the resource interdependent competition, there were shared two containers for the two participants. Participants were asked to start by carrying a ball to the container straight in front of them (6.93 m away from the starting position) and back to the starting position to collect another ball. They were asked to not put balls into the same container twice. So participants might cross each other's route on the way to the container and back, and got blocked

when they were willing to put balls into a same container at the same time, which can result in means interdependence (see Figure 2.1).

Resource independent competition. In the resource independence competition, there were four containers (1 m away from each other) for the two participants. Each participant carried balls to his/her own two containers. Participants were asked to start by carrying a ball to the container straight in front of them (6.93 m away from the starting position) and back to the starting position to collect another ball. They were asked to not put balls into the same container twice in a row. So there were no physical interactions between the two participants, in other words, they performed the task means independently (see Figure 2.1).

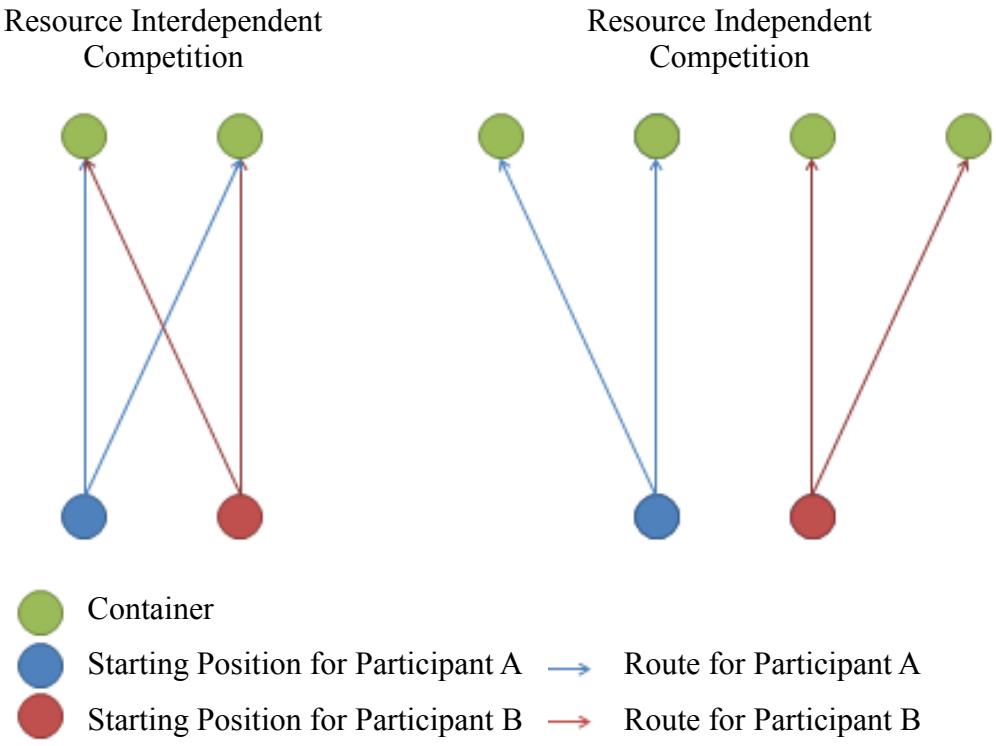

Figure 2.1. Task Condition

Procedure

Participants were asked to complete both conditions in a counter-balanced order. First, participants were instrumented with a heart rate monitor. Then, they were

asked to watch a 5-minute video from the television series episode “Shallow Seas” (Planet Earth) to relax. While watching the video, participants were asked to write down their heart rate displayed on the heart rate monitor when they saw the word “Polar” flashing on the projector screen which came out every minute.

After that, participants were asked to stand at the starting position, one metre away from each other, and complete the SEQ and the first VAS (the first row, only the items about upcoming competition). All the VASs were stuck on the wall in 4 rows by time order. As soon as the first VAS was completed, the task started, the scores of the two participants and the time were displayed on the projector screen in front of them. After the 3rd and 6th minute of the task, the timer was paused. Participants were asked to go back to the starting position to complete the second and the third VAS (the second and the third row, all items). Participants were given 30 seconds to finish the VAS. As soon as the 30 seconds was up, the task continued immediately. After the 9th minute of the task, the task ended and participants were asked to go back to the starting position to complete the fourth VAS (items about the past three minutes of the competition) and SEQ.

Next, participants were asked to walk slowly and sit quietly to relax for 5 minutes while their heart rate were recorded every minute. After that, they were asked to watch a 15-minute video from the television series episode “Shallow Seas” (Planet Earth) to relax. While watching the video, participants were asked to write down the heart rate displayed on the heart rate monitor when they saw the word “Polar” flashing on the projector screen which came out every minute. Then they were asked to perform the task under the other condition. At the end of the session, participants were thanked and debriefed about the aims of the study. The protocol was approved by the local research ethics committee.

Data Reduction and Statistical Analysis

Paired t-tests (resource interdependent condition, resource independent condition) were conducted on the outcome variables (performance, emotion, and effort), and a series of 2 Task Condition (resource independent, resource interdependent) by 2 Time (before, after) repeated measures ANOVAs were conducted on the reported emotions. Moreover, a series of 2 Task Condition (resource independent, resource interdependent) by 3 Time (1st 3-minute, 2nd 3-minute, 3rd 3-minute) repeated measures ANOVA were conducted on emotions, effort, goal-related variables measured during the task. Post hoc tests explored significant interaction effects. Partial eta-squared is reported as a measure of effect size. Values of 0.02, 0.13 and 0.26 indicate small, medium and large effect sizes, respectively (Cohen, 1992).

Results

Performance

The analyses showed that participants performed better under the resource independent condition than the resource interdependent condition, t (13) = 4.28, p = .001 (see Figure 2.2). The 2 Task Condition (interdependent, independent) by 3 Time (1st 3-minute, 2nd 3-minute, 3rd 3-minute) repeated measures ANOVA yielded a significant effect of time on performance, F (2, 26) = 4.02, $p < .05$, $\eta^2 = .24$ (see Figure 2.3). Post hoc tests showed that participants scored less during the second 3-minute period (mean score, 31.54) than the first 3-minute period (mean score, 33.75), t (13) = 4.13, p = .001.

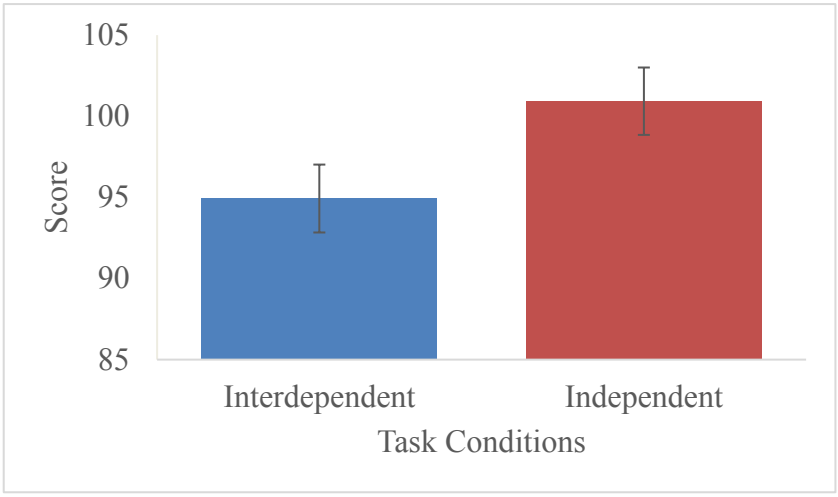

Figure 2.2. Score across Task Conditions. Error bars depict standard error of the means

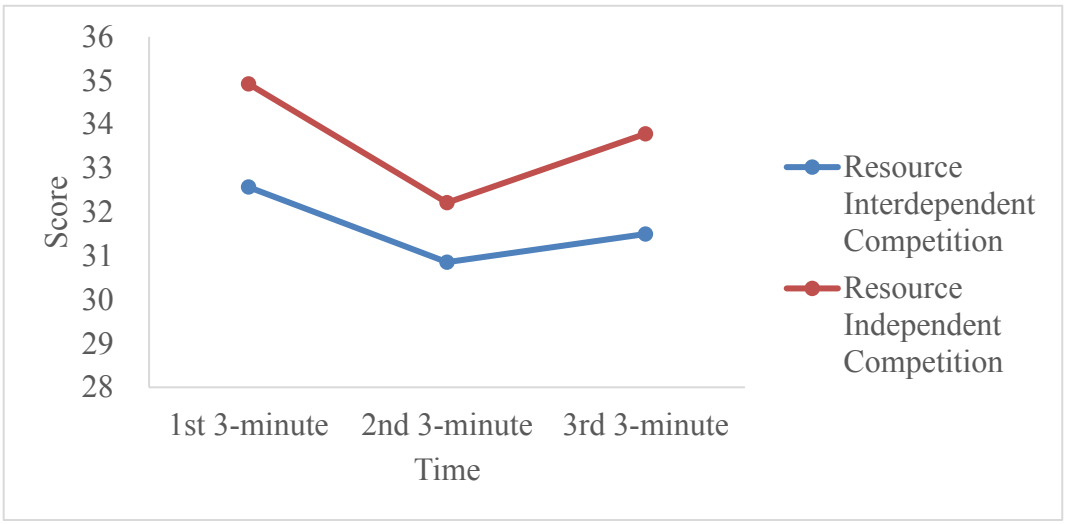

Figure 2.3. Score across Time between Task Conditions

Effort and Goal-related perceptions

The 2 Task Condition by 3 Time (1st 3-minute, 2nd 3-minute, 3rd 3-minute) ANOVA yielded no main effects of task conditions or time on effort (see Figure 2.5) and goal-related perceptions (see Figure 2.4). Significant interaction effects were found on the importance to win, $F\,(2, 26) = 4.64$, $p < .05$, $\eta^2 = .26$. Post hoc tests showed that, during the resource interdependent competition, participants felt that it was more important to win during the second 3-minute period of the task than the first 3-minute period, $t\,(13) = 2.91$, $p < .05$.

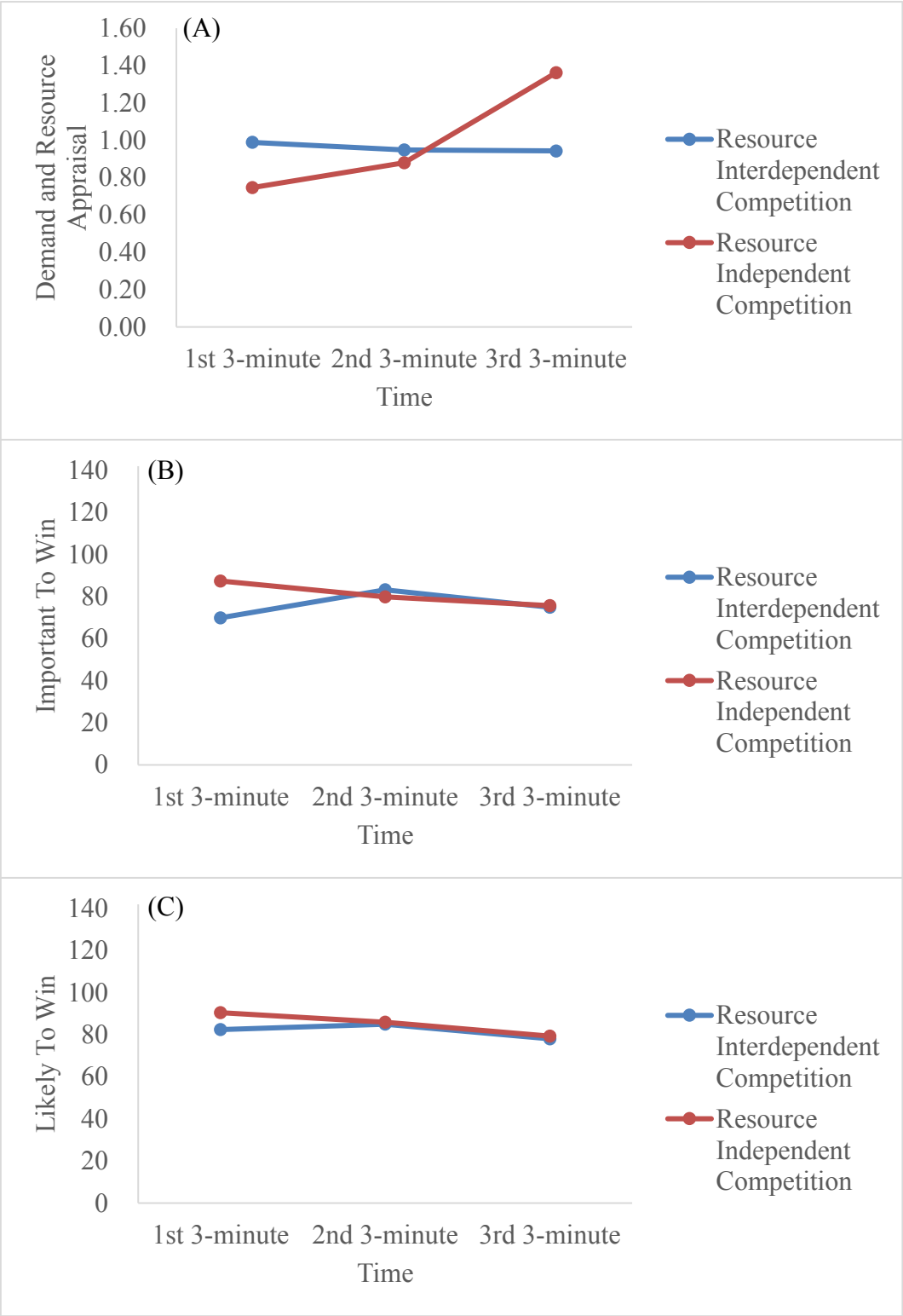

Figure 2.4. (A) Demand and Resource Appraisal across Time between Task Conditions. (B) Important to Win across Time between Task Conditions. (C) Likely to Win across Time between Task Conditions.

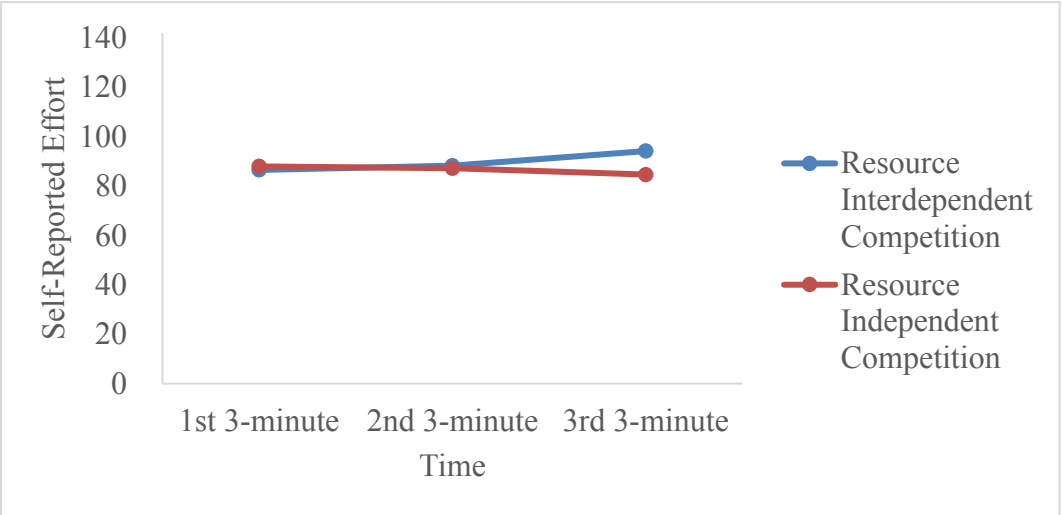

Figure 2.5. Self-Reported Effort across Time between Task Conditions.

Emotion

The 2 Task Condition (interdependent, independent) by 2 Time Point (before, after) repeated measures ANOVAs showed that there were no main effects for task condition and time on emotions measured by SEQ (see Table 2.1).

The 2 Task Condition by 3 Time (1st 3-minute, 2nd 3-minute, 3rd 3-minute) ANOVA yielded no main effects of task conditions or time on emotions measured by VAS. An interaction effect between task conditions and time was found for anger, F (2, 26) = 4.39, $p < .05$, $\eta^2 = .25$. Post hoc tests showed that, under resource interdependent competition, participants were less angry during the last 3-minute period of the task than the first 3-minute period, t (13) = 3.45, $p < .01$ and the second 3-minute period, t (13) = 2.68, $p < .05$ (see Figure 2.6).

Table 2.1

Emotions Before and After the Task across Task Conditions

Variables	Resource Interdependent Competition				Resource Independent Competition			
	Before Task		After Task		Before Task		After Task	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Anxiety	0.74	0.63	0.50	0.49	1.01	0.85	0.79	0.87
Dejection	0.16	0.38	0.14	0.28	0.21	0.36	0.33	0.79
Anger	0.14	0.34	0.25	0.53	0.21	0.35	0.41	0.99
Excitement	1.21	0.84	1.43	0.88	1.68	1.03	1.25	0.83
Happiness	1.18	0.98	1.27	0.70	1.61	1.19	1.14	0.98
Embarrassment	0.19	0.30	0.14	0.15	0.16	0.26	0.19	0.28

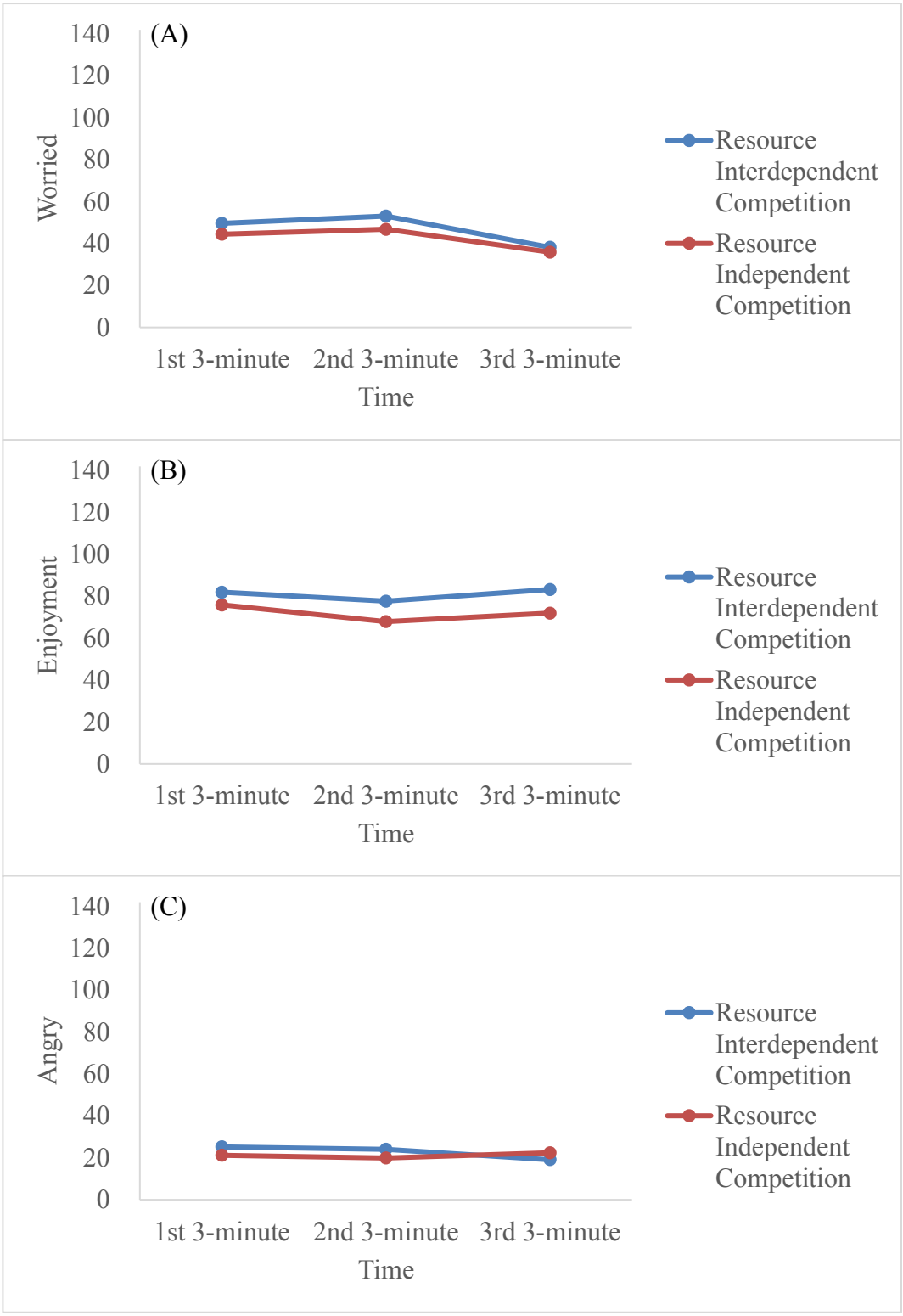

Figure 2.6. (A) Worried across Time between Task Conditions. (B) Enjoyment across Time between Task Conditions. (C) Angry across Time between Task Conditions.

Discussion

The Effects of Between-Team Resource Interdependence

The first aim of the study was to assess the effects of between-team resource interdependence on performance, emotion and goal-related perceptions in an effort-based task. It was hypothesized that performance would be worse in the resource interdependent competition. The hypothesis was supported. The results showed that the score was significantly lower in the resource interdependent competition, which was consistent with Johnson and Johnson's (2005) statement about the negative effects of resource interdependence on performance. They argued that when participants tend to obtain the required resources without a willingness to share their own resources, resource interdependence was likely to result in a detrimental effect on productivity. This suggestion was made under a situation in which positive goals interdependence existed. The current study was the first to test the effects of resource interdependence in a task where negative goals interdependence existed. The current findings extend the use of social interdependence theory to explain the change in performance in different situations. When negative goals interdependence existed, people had to compete for the required resources, and willingness to share the resources were minimized. As a result, it was expected that the adverse effects of resource interdependence would be larger in competition than cooperation.

In addition, the results failed to find a significant difference on emotions, effort, and goal-related perceptions between the resource interdependence competition and the resource independent competition. Contrary to previous research on the effects of emotions on performance (e.g., Cooke et al., 2013; Wilson et al., 2006), it seems that people's outcome of performance can be different without experiencing different emotions. It might be because the level of resource interdependence was not

high enough in the current study, which reduced its effects on enhancing interactions between participants (Gruenfeld, 1995). Another possible explanation was that individuals perhaps felt and performed the same between the two conditions, and the difference in performance was only a result of the interference created by the resource interdependence.

The results of the interaction effects suggested that, when resource interdependence existed, individuals' emotions and goal-related perceptions were varied throughout the task, while their feelings were more consistent under the resource independent condition. Under the resource interdependent competition, participants felt less angry about their opponents during the last stage of the task. It might be because the higher frequency of interaction increased the familiarity between participants, which has been found to lead to a greater level of coordination and result in less negative feelings towards each other (Rockett & Okhuysen, 2002). Despite this, participants also felt that it was more important to win in the middle period of the task than the beginning period when doing the resource interdependent competition. A possible explanation was that after doing the competition for a while, participants perceived the competition differently to the moment before the competition started. It might be because compared to the resource independent competition, the type of social comparison was more direct when the resource interdependence existed, which encouraged individuals to treat the competition more seriously.

In sum, it seems that the mechanism behind the competition-performance relationship might be different between the task with and without resource interdependence. Therefore, it might be worthwhile to consider the difference in resource interdependence when interpreting and implicating the effects of competition on performance. Moreover, in some situations, i.e., resource interdependence

competition, people's emotions and goal-related perceptions might be changing throughout the task, so the measurement conducted before or after the task might not reflect the effects of the manipulation on these outcome variables.

Limitations and Future Directions

There are some limitations of this research that need to be considered when interpreting these findings. First, the effort level that the experiment required might not have been high enough. In this circumstance, all participants tend to view the competition in a challenge state where they thought they all got sufficient resource to meet the demand for achieving the goals. Future studies could use a more competitive task so that participants were encouraged to allocate more effort to the task. Second, the sample size was a bit small in the current study, which might prevent more effects of resource interdependence being observed. Future studies could recruit more participants to further investigate the effects of between-team resource interdependence on performance. Third, the task might have been too short, which might influence the effects of resource interdependence on the interactions among participants. Future studies should conduct in a longer task or in multiple sessions, which might lead to a deeper insight into the effects of resource interdependence.

It would be interesting for future research to study team competitions, which has been found a positive effect on performance (e.g., Cooke et al., 2013). As the frequency of interaction increased in the team competition, the between-team resource interdependence might have a stronger effect on performance than the individual competition. Future studies could also use a skill-based task (e.g., Stanne et al., 1999), in which participants are able to learn and develop skills from others to improve their performance. It was expected that the effects of resource interdependence on performance might be greater as it was likely to impair the learning progress by

forcing individuals to contribute more attentions on fighting for the required resources.

Conclusion

In conclusion, the current study provided evidence to indicate that between-team resource interdependence negatively affected performance in competition. Although no main effects of resource interdependence were found on emotions and goal-related perceptions, the interaction effects indicated the possible difference in the mechanism behind the competition-performance relationship between resource interdependence and resource independence. When resource interdependence existed, individuals' emotions and goal-related perceptions were varied throughout the task, while their feelings were more consistent under the resource independent condition. Future studies should examine the effects of between-team resource interdependence in a different task, e.g., skill-based task, to further investigate the effects of the various types of social interdependence on performance and emotions, which could lead to a better understanding of the nature of competition.

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Chapter 3: The Effects of Between-Team Resource Interdependence and Fairness of Competition in A Team Competitive Basketball Shooting and Rebounding Task on Motor Performance, Emotions and Effort

Abstract

The effects of competition on motor performance have been studied over one hundred years. Due to the lack of clear classification of different types of competition, it is difficult for researchers to take a deeper insight into the competition-performance relationship. Social interdependence theory provides a framework that explains the way a task is structured. By identifying the effects of certain type of interdependence, it can lead to a better way to clarify different types of competition and a better understanding of the nature of competition. The current experiment examined the effects of between-team resource interdependence in an effort and skill mixed task in a two-on-two team competition. Moreover, the effects of the fairness of competition was also examined. 24 males and 24 females were involved in the basketball shooting and rebounding task. Results indicated that the number of baskets made, the number of baskets attempted and the shooting accuracy was higher in the resource independent competition compared to the means interdependent competition. The effects of fairness of competition were not observed. These findings further improved our understanding of the effects of resource interdependence on motor performance.

Introduction

Motor skill performance is relevant to almost everyone's lives. Many studies have considered the effects of different types of competition on motor performance. Social interdependence theory (D W Johnson, 1999; D W Johnson & Johnson, 2005) provides a framework that explains the structure of a task, and thereby competition can be categorized into more specific types. By identifying the effects of social interdependence in different types of competition, it should be possible to obtain a clearer understanding of the nature of competition and its effects on performance, emotions and motivation.

The Effects of Resource Interdependence

Resource interdependence is one important type of means interdependence, which can be defined as the extent in which the resource that each individual controlled to complete the task was affected by other's actions (Ortiz, Johnson, & Johnson, 1996). It can exist between-team and within-team. When resource interdependence is high between teams, people must fight for the resources that are needed to achieve the goal, such as the paint zone area on a basketball court. When resource interdependence is low between teams, all the teams can complete the task without the requirement of others' resources, such as team swimming. Furthermore, when resource interdependence is high within the team, individuals must pool their resources to achieve the goal, such as the playing time in a basketball game. Low resource interdependence or resource independence exist when each individual can accomplish the task without the requirement of any other's resources, such as gymnastics (Fan & Gruenfeld, 1998).

Gruenfeld (1995) suggested that when resource interdependence was high within the team, people tend to interact more through asking and negotiating required

resources, which might help people to recognize multiple strategies and viewpoints, which made them more likely to gain a better understanding of the task. Maier (1970) also proposed that, with a higher level of interaction within the group, individuals might be benefit more from information exchange and helping behaviours (Fan & Gruenfeld, 1998; David W Johnson, 1974), through which the high resource interdependence might help individuals to accomplish the task more effectively.

From a different perspective, high resource interdependence tends to result in process losses (Johnson & Johnson, 2005), where individuals expended their time and effort on team development and maintenance rather than the task, and performance deficits (Fan & Gruenfeld, 1998). Fan and Gruenfeld (1998) argued that when there was more interaction in the group, individuals must contribute more attention to organizing and ordering individual inputs, which might reduce the amount of attention paid to the task itself. Moreover, Ortiz, Johnson, and Johnson, (1996) stated that high resource interdependence might decrease achievement and productivity when people required the resources of other group members with alternative goals, which may lead to a situation where people tend to obtain resources from others without sharing their own resources with them. It seems that the effects of resource interdependence were dependent on the goals interdependence in the task (Evans, Eys, & Bruner, 2012).

Ortiz and his colleagues (1996) investigated the interaction between goals interdependence and resource interdependence in their learning and quiz answering study. They found that participants in the combination of positive goals and resource interdependence group performed best compared to other groups (positive goal interdependence, positive resource interdependence, and no interdependence). They suggested that the improvement effects of positive goals interdependence on

performance was boosted by the additive relationship between positive goal interdependence and resource interdependence.

In the current study, the effects of between-team resource interdependence was examined in a team competition, where positive and negative goals interdependence both exist, to further assess the effects of resource interdependence on motor performance, emotions, and effort, and the interaction between goals interdependence and resource interdependence.

Individual and Team Competition

Many studies have compared people's performance under the individual competition and team competition, and found a positive effect of team competition on performance (e.g. Cooke, Kavussanu, McIntyre, & Ring, 2011; Tauer & Harackiewicz, 2004). For instance, compared to individual competition, high school students have shown greater student peer tutoring, mutual concern, perceived competitiveness and better performance in a mathematics exam (Devries et al., 1973) and science test (Okebukola, 1986) under team competition. Moreover, team competition also improved people's motor performance. Tauer and Harackiewicz (2004) found participants made more free-throws during two-on-two team competition than during one-on-one competition. Similarly, Cooke, Kavussanu, McIntyre, and Ring, (2013) found that participants maintained their grip force for a longer time during a two-on-two competition than a one-on-one competition.

In Tauer and Harackiewicz's (2004) study, participants also reported a higher level of enjoyment in individual competition compared to team competition. Some researchers have stated that competition can make the task more fun, exciting and challenging (Stanne, Johnson, & Johnson, 1999). As a result, people may experience more enjoyment during the task (Cooke et al., 2013; Tauer & Harackiewicz, 2004), or

put more effort into the task (Cooke, Kavussanu, McIntyre, & Ring, 2010; Wilson, Smith, Chattington, Ford, & Marple-Horvat, 2006), which are related to the improvement of performance. It seems that the positive effects of competition on positive emotions were stronger in team competition than when competing as an individual. Cooke, Kavussanu, McIntyre, and Ring, (2013) found that the increased enjoyment from individual competition to team competition fully mediated the improvement in performance. On the other hand, some studies find that the effects of competition can be negative. Research has revealed that people may experience negative emotions, i.e. anxiety, under competition which have been consistently viewed as an impairment of performance (Wilson, Vine, & Wood, 2009; Wilson et al., 2006). Although many studies have examined the effects of competition on emotion and reported different results of the relationship between emotion and performance, very few of these researches considered this discrepancy as a consequence of different types of competition, which might play an important role in explaining the diverse mechanism of emotion-performance relationship under competition.

In addition, previous research studies have found that the change of emotions could result in a change in effort, which might lead the change in performance (Cooke et al., 2013; Tauer & Harackiewicz, 2004). Cooke et al., (2013) reported that the increased anxiety and enjoyment partially mediated the increased self-reported effort. This was consistent with processing efficiency theory, in which performance can be improved by increased anxiety through allocating more effort into the task (Eysenck & Calvo, 1992). Despite this, Wageman and Baker (1997) suggested that participants would put more effort into the task when they simply enjoyed the work more, which led to increased performance. Due to the different effects of individual competition and team competition on motor performance, emotions and effort, the current study

will look at the effects of different level of between-team resource interdependence on performance, emotions and effort in team competition.

Fairness of Competition

Stanne et al., (1999) categorized competition into two types: appropriate competition and inappropriate competition. Appropriate competition occurs when the following conditions are fulfilled: winning is relatively unimportant, every participant has a reasonable chance to win, the rules are clear, the procedure or the progress can be monitored by each other. All other types of competition that excluded from the former conditions are inappropriate competition. In their study, a similar effect on motor performance was observed between cooperation and appropriate competition. They concluded that competing against equally matched opponents to provide everyone a realistic opportunity to win, was one of the four criteria that had to meet to form appropriate competition. They argued that subjects who believed they cannot win would not be motivated by the competition. They might reduce their effort on the task, stop trying to perform better, and have less interest and enjoyment when doing the task (Nolen, 1988; Utman, 1997). This was likely to occur when participants perceived that their ability was not able to meet the demand of completing the task or winning the competition.

In a face-to-face competition, the self-perception of participants' own ability might be affected by the perceived ability of opponents. Stephen and his colleagues (1998) assessed the effects of perceived ability of opponents (toughest, moderate, and weakest) in a basketball team. They found that both male and female players experienced significantly higher level of anxiety and lower level of self-confidence as the ability of opponents increased. As stated above, a higher level of anxiety was found both positively (Cooke et al., 2013; Cooke, Kavussanu, McIntyre, & Ring,

2011) and negatively associated to performance (Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011; Cooke et al., 2010; Wilson et al., 2009; Wilson et al., 2006). It seems that competing against opponents with unmatched ability might be in some extent beneficial to performance. In Stanne and his colleagues' (1999) review, they did not compare the effects of inappropriate competition and appropriate competition on performance. Therefore, the current study further categorized inappropriate competitions into advantageous competition and disadvantageous competition by the ability level of the opponents, and compared the effects of advantageous competition, fair competition and disadvantageous competition on performance to evaluate the role of different fairness conditions in the competition-performance relationship.

Present Study

The first aim of the present study was to investigate the effects of different types of resource interdependent competition on performance, emotions and effort, and to assess the relation among emotions, effort and the change of performance. The second aim was to assess the effects of fairness of competition on performance, emotions, and effort.

Method

Participants

Forty-eight participants (24 male, mean age, 20.25 years, *SD* = .99; 24 female, mean age, 19.46 years, *SD* = 1.29) who were currently playing competitive sports gave informed consent and volunteered to participate in the study, which was approved by the research ethics committee of the University of Birmingham.

Measurements

Task performance. The number of baskets made was recorded and served as the primary measure of performance. The total number of throws attempted was also

recorded. The percentage of baskets made (i.e., the number of baskets divided by the number of shots attempted) was computed to assess shooting accuracy. The total number of throws provided a behavioural measure of effort.

Emotion. Emotions were assessed using the Geneva emotion wheel (GEW; Scherer, 2005, K. Scherer, Shuman, Fontaine, & Soriano, 2013) , and the intrinsic motivation inventory (IMI; Ryan, 1982).

Each item on the VAS consisted of a horizontal dotted line of 142 cm length. Cognitive anxiety was measured by asking "How worried are you feeling?" (Krane, 1994). Enjoyment was assessed by asking "Did you enjoy the competition?". Anger was measured by asking "Did you feel angry with your opponent?". Awkward was assessed by asking "Did you feel awkward because of your opponent, and want to quit the competition?". Participants were asked to indicate how intensely they felt the emotion at that moment in relation to the upcoming competition. The left hand of the 142 cm horizontal scale was labelled "Not at all", and the right hand end, labelled "Extremely".

The GEW consists of 40 emotion words in 20 discrete emotion families (Figure 3.1). It gives participants more freedom to express their feelings by consisting of a free response format, a discrete emotion response format, and a dimensional approach to emotions (Sacharin, Schlegel, & Scherer, 2012). In this study, participants were asked to complete two wheels to describe how they felt at this moment in time towards their opponent and teammate separately. The smallest ring stands for no emotion (coded 1), while the biggest ring (coded 5) stands for high level of emotion.

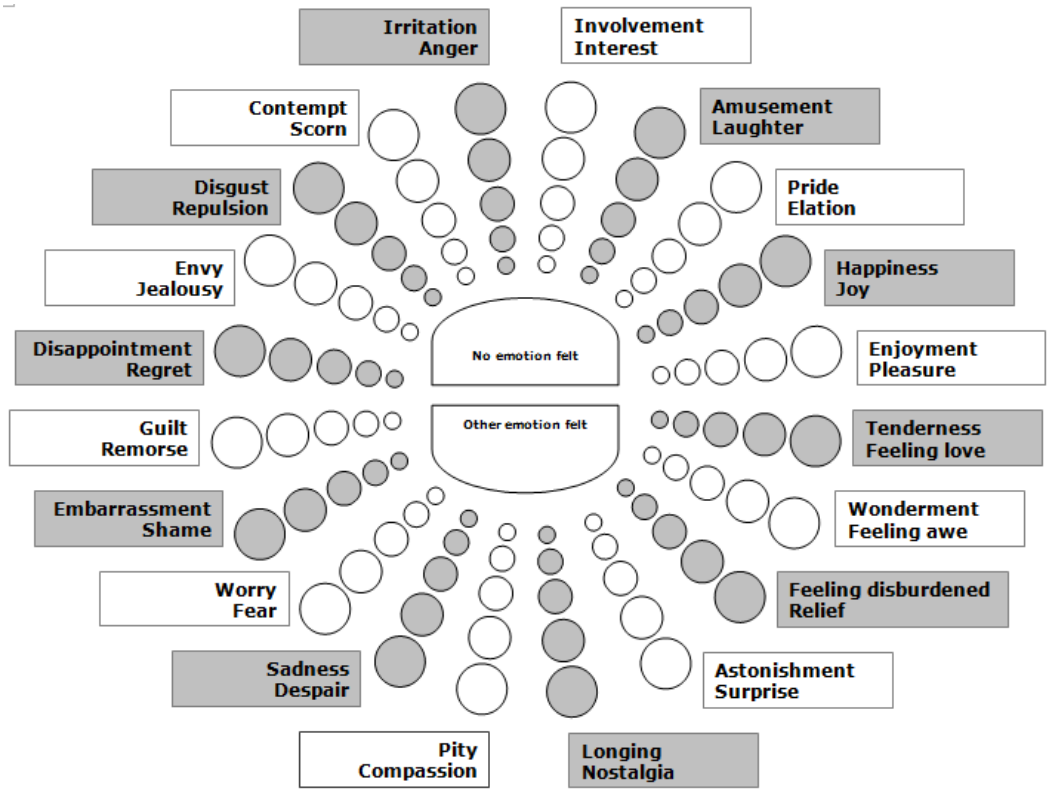

Figure 3.1. GEW with 40 Emotion Terms Arranged in 20 Emotion Families

The 5-item pressure and tension subscale and the 4-item interest and enjoyment subscale of the intrinsic motivation inventory (Ryan, 1982) were used to assess participants' feeling of pressure/tension and interest/enjoyment, respectively. Participants were asked to rate items, including ''I felt pressured'' and ''I felt very tense'' on a 7- point Likert scale (*1=not at all true, 4=somewhat true, 7=very true*). The item responses were averaged to provide one score for the scale.

Effort. In addition to the behavioural measure of effort (number of shots), we also assessed self-reported effort using pressure/tension, perceived competence, enjoyment and effort subscales from the intrinsic motivation inventory (Ryan, 1982) by asking participants to rate items including "I put a lot of effort into this" and "I tried very hard on this activity" on a 7- point Likert scale (*1=not at all true, 4=somewhat true, 7=very true*).

Experimental Design

The study employed a mixed factorial design, with Task Condition (resource interdependent, resource independent) as the within-subjects factor, and Fairness of Competition (advantageous, fair, and disadvantageous) as the between-subjects factor.

Task

The aim of the basketball shooting and rebounding task was to make as many baskets as possible. The task was completed head-to-head by two teams of two participants. All four participants were the same gender and were not friends. One member of the team (the shooter) threw the ball to the hoop from a distance of 4.6 m whereas the second member of team (the rebounder) rebounded, collected the ball, and handed it back to the shooter. The 8-minute task was divided into a series of four 2-minute periods. The role of each member of each team alternated every two minutes (i.e., team member one: shooter, rebounder, shooter, rebounder; team member two: rebounder, shooter, rebounder, shooter).

Task Conditions

Participants completed the basketball task in two counter-balanced task conditions (see Figure 3.2), with a 5-minute rest between conditions. In the means interdependent competition, the two shooters stood at the shooting position (0.6 m away from each other) and were asked to shoot towards the same basket (4.6 m away from the shooting position) at the same time. In this condition, the balls could collide in the air during shooting, and the rebounders could block each other. In the means independent competition, the two shooters stood at the shooting position (5.6 m away from each other) and were asked to shoot towards their own basket (4.6 m away from the shooting position and 5 m between the two baskets). In this condition, there was minimal physical interaction between the opposing teams.

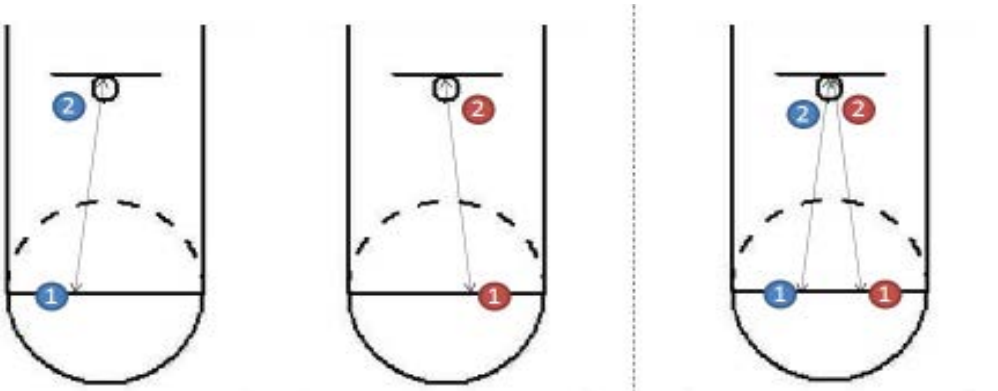

Figure 3.2. Task Conditions

Fairness of Competition

Fair competition. In the fair competition (N = 16), the average score of the baseline test was similar in the two teams, which indicated that participants competed against opponents with similar skill level.

Advantageous competition. In the advantageous competition (N = 16), the average score of the baseline test in the team (mean score, 9.25, SD = 5.21) was higher than the opponent team (mean score, 5.63, SD = 4.98), which indicated that participants competed against opponents with lower shooting skills.

Disadvantageous competition. In the disadvantageous competition (N = 16), the average score of the baseline test in the team (mean score, 5.63, SD = 4.98) was lower than the opponent team (mean score, 9.25, SD = 5.21), which indicated that participants competed against opponents with higher shooting ability

Procedure

Participants completed a baseline screening test to assess their basketball shooting ability: they attempted 20 shots from the shooting position with no time constraint. Participants were assigned into one of 12 different groups depending on their baseline performance score. Participants were told their own and their

teammate's baseline score and that they would perform two inter-group competitions against another pair. The teams were told to try and make more baskets than their opponents. They were also told that they were not allowed to touch the other team's ball or physically interfere with the shooter. Before each task, all four participants completed a GEW ratings and VAS ratings.

At the start of each competition, the highest scoring member of each team at baseline was the shooter and the lowest scoring member was the rebounder. In the case of a tied score, the starting roles was randomly determined. The two participants in each team swapped roles every two minutes. VAS ratings were completed during the 30-s swap period. The shooting position of each team was randomly assigned at the start of the first task, counter-balanced across tasks, and switched half-way through each task.

Data Reduction and Statistical Analysis

A series of 2 Task Condition (resource interdependent, resource independent) by 3 Fairness of Competition (fair, advantageous and disadvantageous) ANOVAs were conducted on performance and effort, and a series of 2 Task Condition by 2 Time (before, after) by 3 Fairness of Competition repeated measures ANOVAs were conducted on emotions. Moreover, a series of 2 Task Condition by 4 Timepoint (1^{st} two-minute, 2^{nd} two-minute, 3^{rd} two-minute, 4^{th} two-minute) by 3 Fairness of Competition repeated measures ANOVAs were conducted on emotions measured during the task. Post hoc tests explored significant interaction effects. Partial eta-squared is reported as a measure of effect size. Values of 0.02, 0.13 and 0.26 indicate small, medium and large effect sizes, respectively (Cohen, 1992). Finally, within-subjects meditation was tested by Judd, Kenny, & McClelland, (2001)'s difference/sum regression procedure.

Results

Performance

The 2 Task Condition × 3 Fairness of Compeition ANOVA yielded a main effect of task condition on the number of baskets made, F (1, 46) = 30.98, $p < .001$, $\eta^2 = .40$, the number of baskets attempted, F (1, 46) = 64.83, $p < .001$, $\eta^2 = 0.59$, and shooting accuracy, F (1, 46) = 14.21, $p < .001$, $\eta^2 = .24$. Performance was worse in the resource interdependent condition than the resource independent condition (see Figure 3.3).

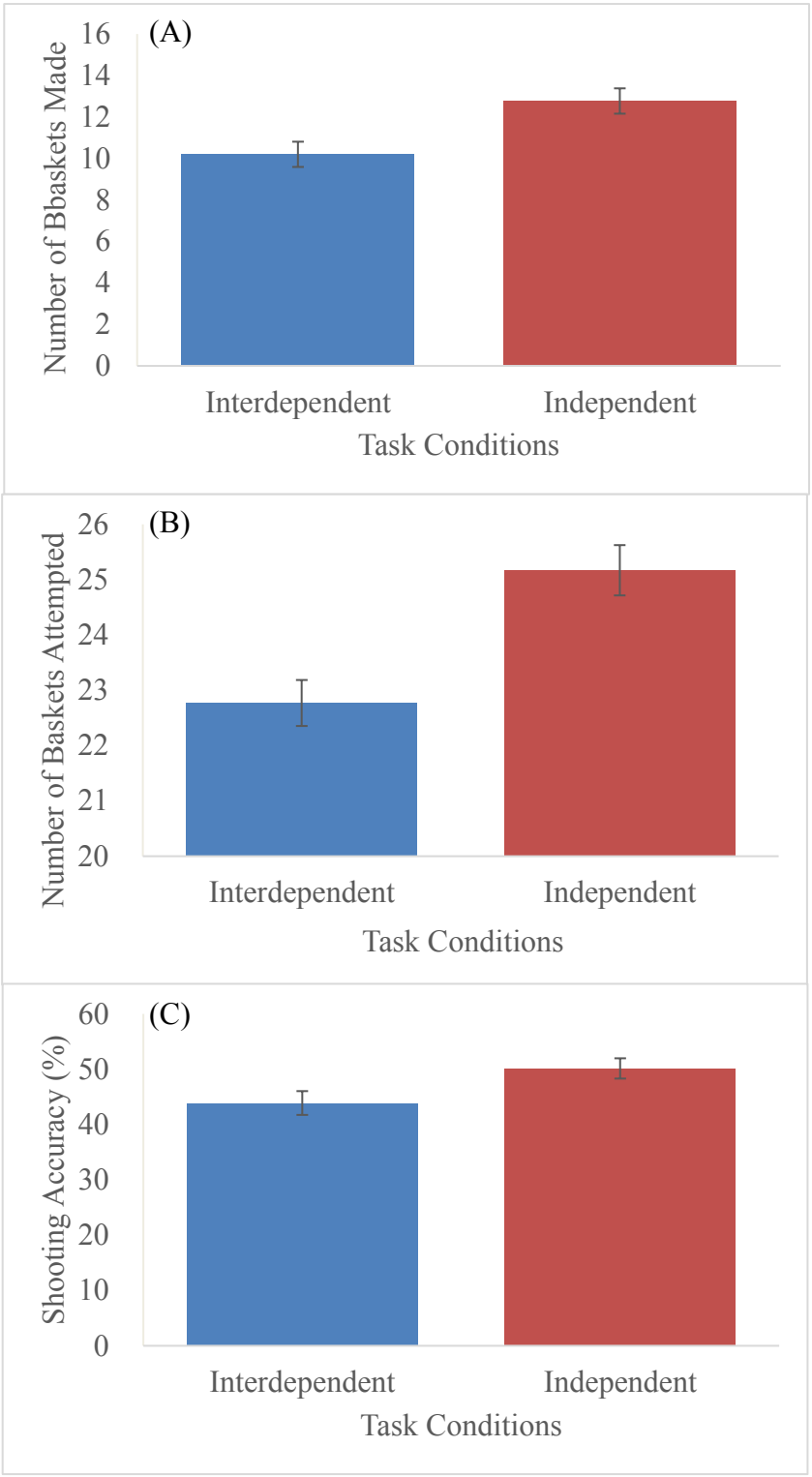

Figure 3.3. (A) Number of Baskets Made across Task Conditions. (B) Number of Baskets Attempted across Task Conditions. (C) Shooting Accuracy across Task Conditions. Error bars depict standard error of the means.

The 2 Task Condition × 3 Fairness of Compeition ANOVA also revealed significant interaction effect between task condition and fairness on the number of baskets made, F (2, 45) = 3.57, $p < .05$, $\eta^2 = .14$, and the number of shots attempted, F (2, 45) = 6.47, $p < .01$, $\eta^2 = .22$, but not on shooting accuracy, F (2, 45) = 2.34, $p = .11$, $\eta^2 = .09$ (see Figure 3.4). Follow-up t tests revealed that, compared to the advantageous competition, the difference in the number of baskets made between the two task conditions (resource independent minus resource interdependent) was larger under the fair competition, t (30) = 3.23, $p < .01$. Moreover, the difference in the number of baskets attempted between the two task conditions were larger in the fair competition when compared to the advantageous competition, t (30) = 3.75, $p = .001$, and disadvantageous competition, t (30) = 3.20, $p < .01$.

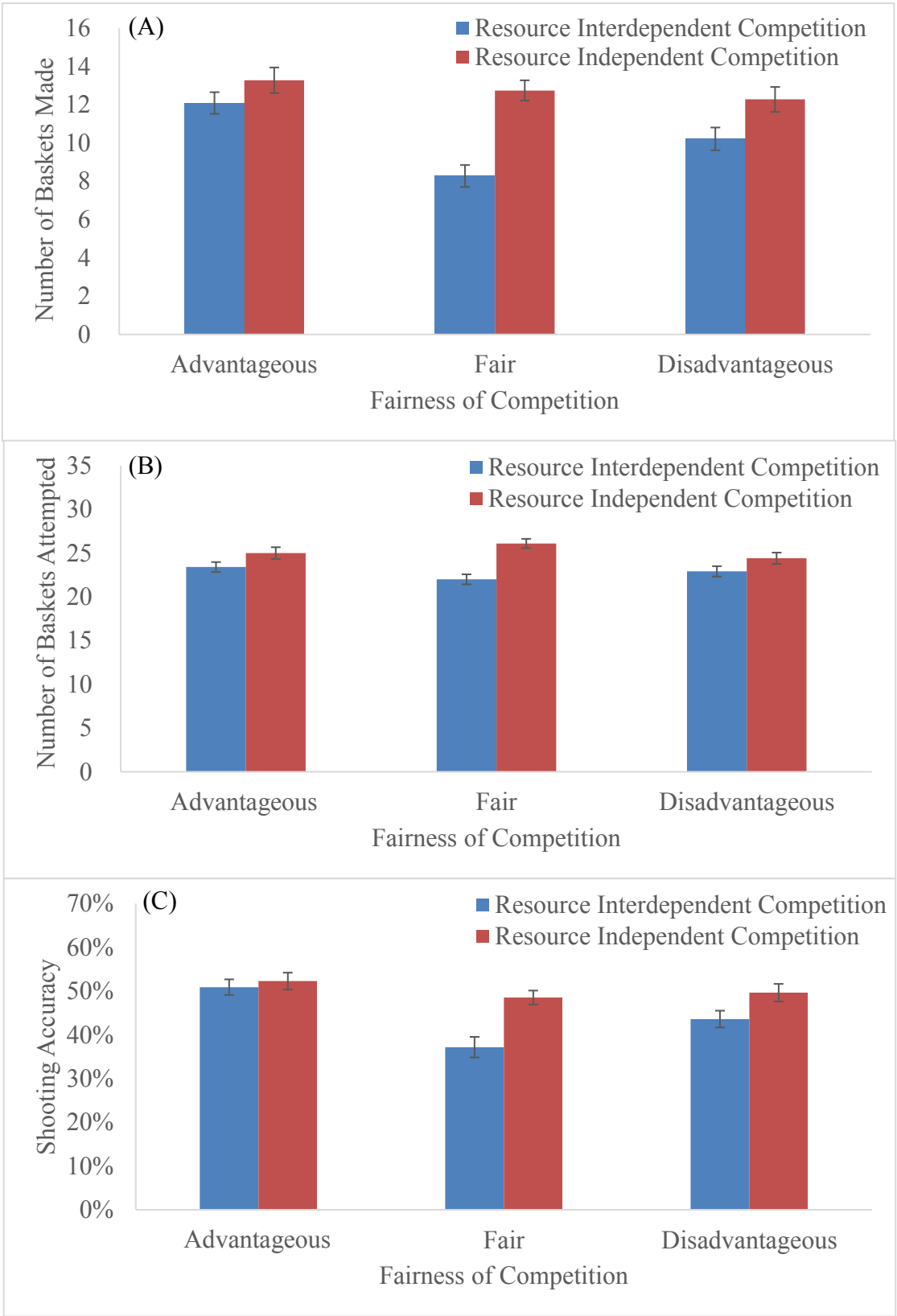

Figure 3.4. (A) Number of Baskets Made across Fairness of Competition. (B) Number of Baskets Attempted across Fairness of Competition. (C) Shooting Accuracy across Fairness of Competition. Error bars depict standard error of the means.

Pressure, perceived competence, enjoyment and self-reported effort

The 2 Task Conditions by 3 Fairness Competition ANOVA revealed no main effects of task condition and fairness of competition on pressure, perceived competence, enjoyment and self-reported effort (see Table 3.1).

Table 3.1

Effects of Task Condition on Pressure, Perceived Competence, Enjoyment and Self-Reported Effort

	Resource Interdependent Competition		Resource Independent Competition		ANOVA		
Variables	*M*	*SD*	*M*	*SD*	$F(1,45)$	*p*	η^2
Pressure	3.04	1.18	2.97	1.13	0.001	.98	.00
Competence	4.35	1.30	4.56	1.19	3.61	.06	.07
Enjoyment	5.00	0.59	4.99	0.65	0.14	.71	.00
Effort	5.05	1.10	4.96	1.12	0.04	.84	.00

Emotion

The 2 Task Condition (interdependent, independent) by 3 Fairness of Competition (Advantageous, Fair, Disadvantageous) by 2 Time Point (before, after) repeated measures ANOVAs yielded main effects for time on the emotions, as assessed by the GEW: compared to the emotions before the task participants felt more positive towards their opponents (see Table 3.2) and teammates (see Table 3.3) after the task.

Compared with their feelings before starting the competition, seven (i.e. amusement, pride, happiness, enjoyment, wonderment, relief and astonishment) out of ten positive emotions towards teammates were significantly increased, and all the effect sizes were moderate to large. One (i.e. astonishment) out of ten positive emotion items towards opponents were significantly increased, the effect sizes were moderate to large. While two (i.e. worry and disgust) out of ten negative emotions

towards their opponents and three (i.e. worry, embarrassment and contempt) out of ten negative emotions towards their teammates were significantly decreased.

In addition, results showed main effect for task condition on happiness towards opponents, $F\,(1, 45) = 4.51$, $p < .05$, $\eta^2 = .09$. Compared to the resource independent competition, participants felt happier about their opponents when doing the resource interdependent competition.

Table 3.2

Emotions Towards Opponents Before and After the Task

	Before Task		After Task		ANOVA		
Variable	*M*	*SD*	*M*	*SD*	*F* (1,45)	*p*	η^2
Interest	3.02	1.00	2.88	1.33	1.59	.21	.03
Amusement	2.45	1.11	2.61	1.39	1.81	.19	.04
Pride	1.95	0.94	2.01	1.40	.33	.57	.01
Happiness	2.42	1.21	2.35	1.43	.25	.62	.01
Enjoyment	2.53	1.24	2.65	1.34	1.31	.26	.03
Tenderness	1.44	0.81	1.40	0.89	.65	.43	.01
Wonderment	1.65	0.94	1.71	1.05	.49	.49	.01
Relief	1.75	1.18	1.74	1.23	.01	.91	<.001
Astonishment	1.75	0.99	2.05	1.28	11.04	.00	.20
Longing	1.36	0.75	1.25	0.72	7.23	.01	.14
Pity	1.39	0.71	1.43	1.05	.21	.65	.01
Sadness	1.29	0.70	1.28	0.67	.02	.89	<.001
Worry	1.77	0.95	1.31	0.61	28.64	<.001	.39
Embarrassment	1.44	0.82	1.41	0.79	.16	.69	<.001
Guilt	1.28	0.66	1.23	0.55	1.18	.28	.03
Disappointment	1.31	0.62	1.38	0.72	1.02	.32	.02
Jealousy	1.49	0.82	1.58	1.02	1.37	.25	.03
Disgust	1.25	0.66	1.13	0.39	6.97	.01	.13
Contempt	1.41	0.82	1.34	0.77	.92	.34	.02
Anger	1.49	0.86	1.50	0.94	.01	.91	<.001

Table 3.3

Emotions Towards Teammates Before and After the Task

	Before Task		After Task		ANOVA		
Variable	*M*	*SD*	*M*	*SD*	*F* (1,45)	*p*	η^2
Interest	3.26	1.08	3.34	1.39	1.11	.30	.02
Amusement	2.68	1.25	3.18	1.44	26.18	<.001	.37
Pride	2.54	1.34	3.30	1.41	67.34	<.001	.60
Happiness	2.84	1.38	3.30	1.40	19.97	<.001	.31
Enjoyment	2.76	1.33	3.30	1.41	26.83	<.001	.37
Tenderness	1.67	1.07	1.73	1.26	.66	.42	.01
Wonderment	1.81	1.24	2.11	1.59	7.81	.01	.15
Relief	1.86	1.36	2.09	1.64	6.24	.02	.12
Astonishment	1.94	1.40	2.25	1.55	11.05	.002	.20
Longing	1.30	0.75	1.33	0.86	.30	.59	.01
Pity	1.28	0.70	1.24	0.69	.46	.50	.01
Sadness	1.24	0.55	1.20	0.50	.67	.42	.01
Worry	1.49	0.77	1.18	0.46	19.79	<.001	.31
Embarrassment	1.44	0.73	1.19	0.51	14.16	<.001	.24
Guilt	1.24	0.58	1.14	0.43	2.83	.10	.06
Disappointment	1.33	0.71	1.24	0.61	1.52	.22	.03
Jealousy	1.33	0.73	1.38	0.81	.27	.61	.01
Disgust	1.18	0.49	1.11	0.39	3.10	.08	.06
Contempt	1.38	0.89	1.25	0.81	5.87	.02	.12
Anger	1.22	0.53	1.19	0.42	.41	.53	.01

The 2 Task Condition × 3 Fairness Competition × 2 Time Point ANOVA also revealed interaction effects between task condition and time point, and between reward condition and time point. The difference in emotions was calculated (after task – before task), and analyzed by a 2 × 3 ANOVAs (task condition × fairness competition). It showed that participants experienced more amusement about their opponents under the resource interdependent condition. The difference on worry about opponents before and after the task was larger under resource interdependent condition (see Table 3.4). There were no significant main effects of task conditions on the diffrence of emotions towards teammates (see Table 3.5).

Significant main effects of fairness of competition was observed on pride towards teammates, longing, disapoointment, and jealousy towards oppoennts. Post hoc *t*-test showed that, compared to the disadvantageous competition, participants felt more pride towards their teammates after doing the task when they were competing with advantages, t (30) = 2.41, $p < .05$. There were no significant difference between the other two pairs of fairness competitions (see Table 3.6). Except that, participants in the disadcantageous compeition also felt less longing, t (30) = 2.52, $p < .05$, more disappointment, t (30) = 2.14, $p < .05$, and more jealousy, t (30) = 2.42, $p < .05$, towards their opponents than participants in the fair compeition after doing the task (see Table 3.7).

Table 3.4

Effects of Task Condition on the Difference of Emotion Towards Opponents Before and After the Task

Variable	Resource Interdependent Competition						Resource Independent Competition								
	Before		After		Difference		Before		After		Difference		ANOVA		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (1,45)	*p*	η^2
Interest	3.06	1.02	2.94	1.10	-.13	1.44	2.98	.93	2.81	1.05	-.17	.91	.03	.87	<.001
Amusement	2.38	1.00	2.88	1.08	.50	1.37	2.52	1.13	2.35	1.16	-.17	1.21	6.25	.02	.12
Pride	1.94	.84	2.08	1.03	.15	1.22	1.96	1.05	1.94	1.12	-.02	.93	.59	.45	.01
Happiness	2.44	.94	2.54	1.11	.10	1.21	2.40	1.09	2.17	1.10	-.23	.95	3.23	.08	.07
Enjoyment	2.48	1.07	2.81	1.10	.33	1.19	2.58	1.05	2.48	1.11	-.10	1.06	3.64	.06	.07
Tenderness	1.42	.68	1.46	.71	.04	.46	1.46	.68	1.33	.63	-.13	.57	2.30	.14	.05
Wonderment	1.60	.82	1.77	.83	.17	.83	1.69	.88	1.65	.84	-.04	.74	2.16	.15	.05
Relief	1.65	.84	1.75	.96	.10	.69	1.85	1.05	1.73	.94	-.13	.91	2.06	.16	.04
Astonishment	1.71	.94	2.21	1.03	.50	.97	1.79	.85	1.90	.99	.10	.93	3.55	.07	.07
Longing	1.40	.61	1.27	.57	-.13	.49	1.33	.60	1.23	.56	-.10	.52	.03	.85	<.001
Pity	1.44	.62	1.46	.82	.02	.84	1.33	.60	1.40	.74	.06	.67	.11	.74	<.001
Sadness	1.27	.57	1.33	.60	.06	.73	1.31	.59	1.23	.47	-.08	.58	1.92	.17	.04
Worry	1.94	.89	1.27	.57	-.67	.88	1.60	.89	1.35	.70	-.25	.89	5.16	.03	.10
Embarrassment	1.44	.80	1.48	.71	.04	.85	1.44	.77	1.33	.66	-.10	.83	.69	.41	.02
Guilt	1.27	.57	1.27	.54	.00	.55	1.29	.50	1.19	.45	-.10	.47	.85	.36	.02
Disappointment	1.35	.53	1.42	.77	.06	.60	1.27	.54	1.33	.63	.06	.76	.00	1.00	<.001
Jealousy	1.54	.82	1.60	.94	.06	.78	1.44	.74	1.56	.90	.13	1.00	.10	.76	<.001
Disgust	1.27	.61	1.15	.36	-.13	.39	1.23	.56	1.10	.31	-.13	.53	.00	1.00	<.001
Contempt	1.42	.74	1.35	.64	-.06	.60	1.40	.64	1.33	.66	-.06	.67	.00	1.00	<.001
Anger	1.50	.74	1.48	.85	-.02	.96	1.48	.80	1.52	.85	.04	.99	.10	.76	<.001

Table 3.5

Effects of Task Condition on the Difference of Emotion Towards Teammates Before and After the Task

Variable	Resource Interdependent Competition						Resource Independent Competition								
	Before		After		Difference		Before		After		Difference		ANOVA		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (1,45)	*p*	η^2
Interest	3.38	.79	3.35	1.02	-.02	.81	3.15	.97	3.33	1.10	.19	.84	1.28	.26	.03
Amusement	2.69	1.06	3.23	1.04	.54	1.03	2.67	1.14	3.13	1.06	.46	.85	.20	.66	<.001
Pride	2.50	1.09	3.23	1.17	.73	1.01	2.58	1.13	3.38	1.00	.79	.94	.09	.76	<.001
Happiness	2.92	1.11	3.31	1.01	.40	.84	2.77	1.10	3.29	1.05	.52	1.01	.54	.47	.01
Enjoyment	2.73	1.11	3.23	1.10	.50	.97	2.79	1.07	3.38	1.02	.58	1.09	.15	.70	<.01
Tenderness	1.73	.98	1.67	1.00	-.06	.89	1.60	.79	1.79	.92	.19	.67	2.23	.14	.05
Wonderment	1.77	1.06	2.02	1.08	.25	.91	1.85	.99	2.21	1.25	.35	1.04	.31	.58	.01
Relief	1.81	1.07	2.10	1.26	.29	.82	1.92	1.07	2.08	1.20	.17	.83	.62	.44	.01
Astonishment	1.98	1.23	2.21	1.09	.23	.93	1.90	1.02	2.29	1.27	.40	1.03	.67	.42	.01
Longing	1.29	.50	1.31	.59	.02	.48	1.31	.66	1.35	.67	.04	.54	.05	.83	<.01
Pity	1.25	.64	1.25	.60	.00	.65	1.31	.69	1.23	.56	-.08	.58	.40	.53	.01
Sadness	1.25	.53	1.25	.53	.00	.65	1.23	.47	1.15	.36	-.08	.40	.49	.49	.01
Worry	1.56	.82	1.21	.46	-.35	.76	1.42	.61	1.15	.36	-.27	.57	.38	.54	.01
Embarrassment	1.48	.80	1.25	.57	-.23	.78	1.40	.68	1.13	.33	-.27	.61	.08	.78	<.01
Guilt	1.23	.47	1.17	.43	-.06	.60	1.25	.57	1.10	.31	-.15	.50	.64	.43	.01
Disappointment	1.38	.67	1.31	.66	-.06	.81	1.29	.65	1.17	.48	-.13	.67	.17	.68	<.01
Jealousy	1.38	.61	1.46	.74	.08	.71	1.29	.58	1.29	.58	.00	.62	.60	.44	.01
Disgust	1.17	.38	1.15	.41	-.02	.44	1.19	.45	1.08	.28	-.10	.37	.83	.37	.02
Contempt	1.35	.67	1.27	.61	-.08	.61	1.40	.77	1.23	.59	-.17	.60	.34	.56	.01
Anger	1.21	.41	1.29	.58	.08	.58	1.23	.56	1.08	.28	-.15	.55	4.08	.05	.08

Table 3.6

Effects of Fairness of Competition on the Difference of Emotion Towards Teammates Before and After the Task

Variable	Advantageous Competition						Fair Competition						Disadvantageous Competition						ANOVA		
	Before		After		Difference		Before		After		Difference		Before		After		Difference				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (2,45)	*p*	η^2
Interest	3.03	.72	3.19	1.01	.16	.51	3.44	.75	3.50	.98	.06	.54	3.31	.81	3.34	.94	.03	.59	.23	.80	.01
Amusement	2.41	.69	3.09	.80	.69	.63	2.94	.81	3.31	1.09	.38	.65	2.69	1.09	3.13	1.13	.44	.75	.96	.39	.04
Pride	2.31	.91	3.41	.93	1.09	.76	2.66	.96	3.34	1.08	.69	.51	2.66	.96	3.16	.98	.50[a]	.63	3.58	.04	.14
Happiness	2.59	1.00	3.31	.98	.72	.77	2.91	.93	3.28	1.13	.38	.70	3.03	.99	3.31	.83	.28	.66	1.68	.20	.07
Enjoyment	2.63	.90	3.31	.96	.69	.75	2.81	1.00	3.38	1.09	.56	.77	2.84	.91	3.22	.93	.38	.65	.75	.48	.03
Tenderness	1.34	.51	1.50	.80	.16	.68	1.78	.89	1.69	.89	-.09	.49	1.88	.81	2.00	.98	.13	.39	1.05	.36	.05
Wonderment	1.69	.81	1.97	1.16	.28	.82	1.69	.81	1.94	1.01	.25	.82	2.06	1.00	2.44	1.20	.38	.59	.12	.89	.01
Relief	1.59	.90	1.72	1.11	.13	.62	1.94	.98	2.19	1.14	.25	.68	2.06	1.00	2.38	1.22	.31	.60	.36	.70	.02
Astonishment	1.81	.87	2.16	1.26	.34	.72	1.94	1.01	2.16	.94	.22	.73	2.06	1.06	2.44	1.06	.38	.47	.26	.77	.01
Longing	1.13	.29	1.25	.55	.13	.39	1.38	.65	1.34	.70	-.03	.46	1.41	.58	1.41	.55	.00	.32	.71	.50	.03
Pity	1.13	.34	1.16	.44	.03	.13	1.06	.17	1.06	.17	.00	.18	1.66	.77	1.50	.71	-.16	.70	.90	.42	.04
Sadness	1.06	.25	1.06	.25	.00	.00	1.16	.35	1.19	.36	.03	.43	1.50	.52	1.34	.44	-.16	.44	1.30	.28	.06
Worry	1.34	.47	1.06	.25	-.28	.45	1.28	.41	1.09	.27	-.19	.31	1.84	.70	1.38	.43	-.47	.64	1.39	.26	.06
Embarrassment	1.22	.31	1.13	.34	-.09	.38	1.28	.45	1.06	.17	-.22	.41	1.81	.70	1.38	.50	-.44	.57	2.29	.11	.09
Guilt	1.16	.35	1.13	.34	-.03	.39	1.19	.40	1.00	.00	-.19	.40	1.38	.47	1.28	.41	-.09	.49	.54	.59	.02
Disappointment	1.09	.27	1.13	.29	.03	.22	1.25	.48	1.09	.27	-.16	.60	1.66	.68	1.50	.63	-.16	.65	.68	.51	.03
Jealousy	1.31	.44	1.31	.60	.00	.48	1.19	.36	1.13	.22	-.06	.31	1.50	.68	1.69	.75	.19	.77	.88	.42	.04
Disgust	1.09	.27	1.06	.25	-.03	.13	1.13	.29	1.00	.00	-.13	.29	1.31	.44	1.28	.41	-.03	.29	.78	.47	.03
Contempt	1.34	.60	1.22	.55	-.13	.39	1.34	.60	1.22	.60	-.13	.39	1.44	.68	1.31	.57	-.13	.29	.00	1.00	.00
Anger	1.09	.27	1.06	.25	-.03	.13	1.19	.31	1.03	.13	-.16	.30	1.38	.50	1.47	.43	.09	.49	2.16	.13	.09

Note. a denote significant differences from advantageous competition

Table 3.7

Effects of Fairness of Competition on the Difference of Emotion Towards Opponents Before and After the Task

Variable	Advantageous Competition						Fair Competition						Disadvantageous Competition						ANOVA		
	Before		After		Difference		Before		After		Difference		Before		After		Difference				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (2,45)	*p*	η^2
Interest	2.81	.81	2.66	.91	-.16	.60	2.97	.67	2.97	1.04	.00	1.03	3.28	.63	3.00	.86	-.28	.71	.50	.61	.02
Amusement	2.09	.52	2.41	.71	.31	.48	2.69	.63	2.81	1.14	.13	.94	2.56	1.08	2.63	1.04	.06	1.05	.37	.69	.02
Pride	1.72	.55	1.78	.77	.06	.66	2.09	.74	2.09	1.29	.00	.95	2.03	.69	2.16	.81	.13	.62	.11	.90	.01
Happiness	2.13	.81	2.03	.83	-.09	.84	2.41	.84	2.44	1.30	.03	.96	2.72	.91	2.59	.82	-.13	.81	.14	.87	.01
Enjoyment	2.13	.81	2.47	.81	.34	.57	2.63	.81	2.56	1.24	-.06	.81	2.84	1.00	2.91	.71	.06	.68	1.43	.25	.06
Tenderness	1.28	.41	1.19	.36	-.09	.27	1.31	.57	1.34	.57	.03	.22	1.72	.71	1.66	.85	-.06	.51	.53	.59	.02
Wonderment	1.38	.56	1.44	.70	.06	.48	1.53	.62	1.56	.73	.03	.56	2.03	.78	2.13	.79	.09	.78	.04	.96	<.001
Relief	1.59	.80	1.47	.62	-.13	.62	1.69	.96	1.78	1.03	.09	.38	1.97	.72	1.97	.90	.00	.75	.53	.59	.02
Astonishment	1.53	.72	1.81	1.08	.28	.68	1.72	.60	1.91	.74	.19	.63	2.00	.77	2.44	.87	.44	.57	.64	.53	.03
Longing	1.22	.36	1.16	.44	-.06	.25	1.28	.48	1.28	.52	.00	.18	1.59	.69	1.31	.57	-.28[b]	.41	4.00	.03	.15
Pity	1.22	.31	1.34	.65	.13	.56	1.34	.51	1.41	.90	.06	.70	1.59	.64	1.53	.64	-.06	.63	.36	.70	.02
Sadness	1.09	.27	1.22	.36	.13	.29	1.19	.36	1.22	.41	.03	.39	1.59	.74	1.41	.61	-.19	.79	1.43	.25	.06
Worry	1.41	.46	1.19	.44	-.22	.45	1.56	.54	1.06	.17	-.50	.55	2.34	.93	1.69	.57	-.66	.75	2.23	.12	.09
Embarrassment	1.22	.31	1.22	.45	.00	.45	1.41	.64	1.28	.66	-.13	.43	1.69	.70	1.72	.55	.03	.72	.37	.70	.02
Guilt	1.13	.29	1.13	.29	.00	.18	1.28	.52	1.16	.35	-.13	.34	1.44	.54	1.41	.49	-.03	.43	.61	.55	.03
Disappointment	1.19	.36	1.13	.29	-.06	.25	1.28	.45	1.22	.41	-.06	.31	1.47	.50	1.78	.73	.31[ab]	.63	4.06	.02	.15
Jealousy	1.28	.41	1.38	.74	.09	.49	1.38	.62	1.22	.45	-.16	.65	1.81	.68	2.16	.91	.34[b]	.51	3.25	.05	.13
Disgust	1.09	.27	1.09	.27	.00	.18	1.19	.44	1.03	.13	-.16	.35	1.47	.62	1.25	.37	-.22	.41	1.89	.16	.08
Contempt	1.34	.51	1.13	.29	-.22	.41	1.34	.54	1.38	.72	.03	.46	1.53	.67	1.53	.53	.00	.48	1.45	.25	.06
Anger	1.38	.50	1.22	.45	-.16	.51	1.47	.67	1.34	.54	-.13	.72	1.63	.65	1.94	.91	.31	.63	2.82	.07	.11

Note. a denote significant differences from advantageous competition, b denote significant differences from fair competition

The 2 Task Condition × 4 Timepoint × 3 Faireness of Compeition ANOVA yielded a main effects of fairness compeition on worry, F (2, 45) = 4.62, $p < .05$, $\eta^2 = .17$, awkward, F (2, 45) = 5.96, $p < .01$, $\eta^2 = .21$, and anger, F (2, 45) = 3.16, $p < .05$, $\eta^2 = .17$. Post hoc analysis showed that participants in the disadvantageous competition felt more worry, t (30) = 2.78, $p < .01$, awkward, t (30) = 3.03, $p < .01$, and anger, t (30) = 2.87, $p < .01$, than participants in the advantageous competition. They also felt more awkward than participants in the fair competition, t (30) = 2.39, $p < .05$. There were no significant differences between the advantageous compeition and fair compeition.

Mediation Analysis

The ANOVAs reported above indicated that performance increased from resource interdependent competition to resource independent competition. To further investigate whether potential variables (e.g. emotions and the difference of emotions) predicted the difference of performance. I used Judd, Kenny, & McClelland, (2001)'s difference regression to test mediation in with-in subject design. To conduct these analyses, there must be significant difference across conditions in the dependent variable and potential mediator variables. In the current study, the difference in the number of baskets made, the number of baskets attempted, and shooting accuracy was all significant between the resource interdependent competition and the resource independent competition. Happiness towards opponents and the difference of worry towards opponents were found as potential mediators. The results showed that the difference in both potential mediators did not predict the difference in the dependent variables (ps > .28). No mediating effects of emotions were found in the current study.

Discussion

Effects of Resource Interdependence on Performance, Emotions, and Effort

The primary purpose of this study was to investigate the effects of between-team resource interdependence on performance, emotions, and effort. That the number of baskets made, the number of baskets attempted and the shooting accuracy was higher in the resource independent competition compared to the means interdependent competition indicated that participants performed much better in means independent competition.

These findings supported social interdependence theory (D W Johnson, 1999), which states that resource interdependence might decrease achievement and productivity, compared with resource independence (D W Johnson & Johnson, 2009). The theory argued that when individuals required the resource from other group members who did not share common goals, they tend to obtain resources from others without sharing their own resources. Therefore, resource interdependence is likely to interfere each other's productivity (D W Johnson & Johnson, 2009). In the current study, resource interdependence was manipulated between groups, where space was the required resource for both teams to complete the task. Compared to the resource independent competition, participants faced more interference during the rebounding and shooting in the resource interdependent competition. It was expected that there would be a decrease in the number of baskets made and attempted because these two measures were all effort based to some extent, which was more likely to be influenced by productivity. It seems that the negative goals interdependence between teams strengthened the effects of resource interdependence on performance.

In addition, shooting accuracy also decreased from the resource independent competition to the resource interdependent competition. It seems that resource interdependence had a stronger detrimental effect on the number of baskets attempted, which was reflected in the results as the effect size for the difference in the number of

baskets attempted was larger than that for the number of baskets made. This might be because participants' skill levels were mixed in the current study, which gave those who performed badly in the baseline test an opportunity to learn and improve their skills while doing the competition. This effect was larger under resource independent condition because participants could concentrate more on learning and copying the skill from their partners with less interruption from their opponents. As a result, participants' shooting improved, especially for those ranked bottom in the baseline test, which led to a significant increase in skill-based performance, i.e. shooting accuracy, from the resource interdependent competition to the resource independent competition.

After finishing the task, participants felt more positive towards their opponents (e.g. astonishment) and teammates (e.g. amusement, pride, happiness, enjoyment, wonderment, relief, and astonishment). They also felt less negative towards their opponents (e.g. worry and disgust) and teammates (e.g. worry, embarrassment and contempt) when comparing the emotion before and after doing the task. The current findings are in line with many studies that compared the effects of competition and non-competition on emotions (e.g. Cooke, Kavussanu, McIntyre, & Ring, 2011; Tauer & Harackiewicz, 2004), in which participants felt more enjoyment in the competition. Tauer and Harackiewicz (1999, 2004) stated that competition could make activities more enjoyable, as a result, individuals can have more positive feelings while doing the task. Moreover, compared to the resource independent competition, participants felt happier towards their opponents in the resource interdependent competition. They also felt less worried towards their opponents after doing the resource interdependent competition. It might be because the between-team resource interdependence created a more competitive environment which induce more pressure, and at the same time

more fun into the task. In contrast with the enjoyment-based mechanism, in which more positive emotions could predict better performance, participants can experience more positive emotions with a worse outcome. In other words, resource interdependence had a stronger influence on performance than emotions, which indicated that the mechanism behind the competition-performance relationship were different in different types of competition.

Effects of Fairness of Competition on Performance, Emotions, and Effort

The secondary purpose of this study was to assess the effects of fairness of competition on performance, emotions, and effort. Results showed there were no main effects of fairness of competition on performance and effort. The findings failed to support Johnson and Johnson's (1989) method of classifying competition into appropriate competition and inappropriate competition, in which they proposed that appropriate competition could improve performance while inappropriate competition would not. Therefore, the conditions of appropriate competition might need further investigation. Despite this, the absence of the effects of fairness of competition on performance between the advantageous and disadvantageous group might be because the low ability participants did not perceive clearly or quickly their opponents' high ability. The difference in perceived ability between the advantageous competition and the disadvantageous competition was not large enough, which limited the negative effect of unfairness of competition on performance and effort. Therefore, the participants were still able to engage into the task, learn from their teammates and opponents, and obtain happiness and interest in the disadvantageous competition (Utman, 1997).

In addition, compared to the advantageous competition, participants felt more negative emotion during the disadvantageous competition. My findings were

supported by Stephen, Satvros and Robert's study (1998), in which subjects experienced more anxious when facing opponents with high perceived ability. According to the theory of challenge and threat state (Jones et al., 2009), individual's emotion state would be more positive in challenge than threat states. Skinner and Brewer (2004) also suggested that participants were likely to experience more positive emotions following a challenge appraisal, which tend to be beneficial to performance. In contrast, participants were likely to experience more negative emotions following a threat appraisal, which could be harmful to performance (Skinner & Brewer, 2004). In the current study, participants determined the challenge and threat state by their own perceived skill level for completing the task, and the knowledge of their opponents' ability. Therefore, it was more likely for participants to experience a threat state during disadvantageous competition, which might have lead to a more negative emotional state.

Limitations and Future Directions

There are some limitations of this research that need to be considered when interpreting these findings. First, the average ability of participants in the disadvantageous competition might not have been low enough, which might have reduced the ability gap between participants in the disadvantageous competition and the advantageous. Future studies could control the ability gap better by building the disadvantageous team with lower skill player, and competing against the team with top level of skills. Second, the team size was small, which reduce the frequency of interaction between the teams and within the team. With a bigger team size, the competition on obtaining the required resources would be more intense. Moreover, there would be more interactions among participants, which has been associated with more information exchange and helping behaviours (Fan & Gruenfeld, 1998; David

W Johnson, 1974). As a result, the effects of between-team resource interdependence on performance and emotions might be stronger.

It would be interesting for future research to add measures of challenge and threat state, such as the demand / resource evaluation (Moore, Vine, Wilson, & Freeman, 2012), which can provide a more detailed explanation on the change in performance and emotions. Future studies could also obtain more detailed information of performance by using motion analysis or kinematic measures, which can provide a more detailed insight into the relationship between emotions and performance (M. R. Wilson et al., 2009). Finally, future studies could also test the effects of between-team resource interdependence in experts. Because the effects of anxiety was different in non-experts and experts (Cooke, Kavussanu, McIntyre, Boardley, et al., 2011), it would be worthwhile to find out whether the effects of between-team resource interdependence was the same between non-experts and experts.

Conclusion

In conclusion, the current study provided evidence to indicate that resource interdependence had a negative effect on performance in team competition. Combined with the results from previous studies (see Chapter 2), the effects of resource interdependence on performance was at an individual level (within team) and team level (between team). Although a higher level of positive emotions (i.e. happiness) were found in the resource interdependence condition, there were no mediation effects found between emotions and performance, which indicated that the mechanism behind the effects of resource interdependence on performance might be different. Moreover, people's performance was similar under fair competition and unfair competition (advantageous and disadvantageous). Although people felt more positive under advantageous competition, they failed to translate the positive emotions

into effort and successful performance. It seems that the relationship between emotions and performance in competition was highly depend on the type of interdependence that exists in the task. Future studies should examine the effects of other types of interdependence, e.g. reward interdependence, to further investigate the effects of different types of interdependence on performance and emotions, and the mechanism behind it, which was important on clarifying different types of competition and getting a better understanding of the nature of competition.

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Chapter 4: The Effects of Between-Team Resource Interdependence and With-In Team Reward Interdependence in A Team Competitive Basketball Shooting and Rebounding Task

Abstract

Team competition is very common in sports. However, the effects of team competition on performance and its mechanism are still unclear. The lack of clear classification of different types of competition is believed to cloud the understanding of competition-performance relationship. Social interdependence theory provides a framework that explains the way a task is structured. By identifying the effects of certain type of interdependence, it can lead to a better way to clarify different types of competition and a better understanding of the nature of competition. The current experiment examined the effects of high reward interdependence and its interaction with between-team resource interdependence on performance, emotions and effort in team competition. 32 males and 16 females were involved in the basketball shooting and rebounding task. Results showed no difference in performance between the high reward interdependent condition and the low reward interdependent condition. The number of baskets attempted and the number of baskets made were found higher in resource independent condition. Mediation analysis suggested self-reported effort fully mediated the change in performance between resource interdependent and resource independent condition. Interaction results were found between resource interdependence and reward interdependence. These findings improved our understanding of the effects of resource interdependence, reward interdependence and their interaction on motor performance.

Introduction

Reward interdependence can be defined as the extent to which the reward an individual can get depends on the performance of others (Johnson & Johnson, 2005). It is one important type of outcome interdependence and has been examined in many studies (e.g. Allen, Sargent, & Bradley, 2003; Buchs, Gilles, Dutrévis, & Butera, 2011; Wageman & Baker, 1997). It can be categorized as low reward interdependence (or reward independence) and high reward interdependence. Low reward interdependence is one given to everyone regardless their performance, such as appearance money. High reward interdependence, by contrast, is one given to individuals based completely on their performance in the group, such as performance related pay (Wageman, 1995). The effects of high reward interdependence have been examined in education and work settings, but seldom in sports. Several researchers have reported that high reward interdependence had positive effects on information exchange, productivity and perception of group effectiveness in cooperative tasks (DeMatteo, Eby, & Sundstrom, 1998; Moser & Wodzicki, 2007), whereas others found no effects (Wageman, 1995). The current study aims to determine the effects of reward interdependence on performance in a physical activity task, and thereby improve our understanding of the way in which social interdependence may affect people's performance.

Previous studies have examined both task interdependence and reward interdependence. In Wageman and Baker's (1997) study, participants were asked to complete an article error correction task. Before doing the task, each was trained with the ability to recognize general errors and one of the two specific type of errors. The percentage of the errors that an individual could find out from the article given to him or her without his / her partner's knowledge, was varied from 50%, 66%, to 100%,

which manipulated the low, moderate, and high task interdependence. Different levels of reward interdependence were manipulated by the percentage of reward an individual could get from each error he/she found out; it varied from 50%, 70% to 100%, the rest of the reward was given to his / her partner. Their results showed that participants in the high reward interdependence group (n = 19) performed significantly better than low reward interdependence group (n = 18), while there was no effect of task interdependence on performance.

Allen, Sargent, and Bradley (2003) did a similar study with a larger group size. In their study, a group of three participants were asked to complete the article error correction task. They manipulated task interdependence in two levels. Under the low task interdependent condition, each participant was able to recognize 100% of the errors from the provided article with the specific type of training he / she got. While under the high task interdependent condition, each participant was only able to recognize 40% of the errors with the knowledge he / she has been taught. However, they found no significant effects of either task interdependence nor reward interdependence on performance. They argued that the task might have been too complicated, which decreased the participants' average ability to complete the task, therefore limited the positive effects of high task interdependence and high reward interdependence on performance.

Moser and Wodzicki (2007) stated that high task interdependence might create ceiling effects to prevent high reward interdependence from being an extra incentive because the reward can only be obtained when people shared their information and cooperated well. In contrast, they argued that in a low task interdependence condition, people might not be motivated to share their knowledge or help other group members, so high reward interdependence cannot act as an additional incentive for cooperation

as well. In their study, they compared low reward interdependence and high reward interdependence under a low-to-moderate task interdependence condition and found that high reward interdependence acted as an effective incentive to promote team cooperation and information sharing when task interdependence was low or moderate. However, the effects of high reward interdependence might work differently in sports because participants tend to be more open and encouraged to share while doing a physical activity. In the current study, the effects of high reward interdependence will be tested in a high task interdependent condition.

Effects of Competition on Performance

Many studies testing reward interdependence were structured with a cooperative task under a do your best condition (DeMatteo et al., 1998; Moser & Wodzicki, 2007; Wageman, 1999). However, compared to a competitive condition, the do your best condition might limit the effects of high reward interdependence being an extra incentive. Many studies have compared people's performance with competition and without competition (e.g. Cooke, Kavussanu, McIntyre, & Ring, 2011; Tauer & Harackiewicz, 2004; van de Pol, Kavussanu, & Ring, 2012). Some researchers have stated that the effects of competition on performance could be positive as it makes the task more fun, exciting and challenging (Stanne, Johnson, & Johnson, 1999). As a result, people may experience more enjoyment during the task (Cooke, Kavussanu, McIntyre, & Ring, 2013; Tauer & Harackiewicz, 2004), or put more effort into the task (Cooke, Kavussanu, McIntyre, & Ring, 2010; Wilson, Smith, Chattington, Ford, & Marple-Horvat, 2006), which are related to the improvement of performance. It is possible that high reward interdependence might amplify these effects and motivate people to put more effort into the task and perform better. On the other hand; some studies find that the effects of competition can be negative.

Research has revealed that people may experience negative emotions, such as anxiety, under competition which have been consistently viewed as an impairment of performance (Wilson, Vine, & Wood, 2009; Wilson et al., 2006). It seems that different types of competition could affect performance through emotions, effort, or both.

Effects of Competition on Emotion

Competitions often consist of social comparison and evaluation (Martens, 1975), which can be seen as a source of challenge (Tauer & Harackiewicz, 2004) and at the same time, a source of pressure (Cooke, Kavussanu, McIntyre, & Ring, 2011). As such, during competition, people may experience enjoyment, a positive emotion that is characterized by pleasant feelings, which have been studied in previous research and showed a positive effect on performance (Cooke et al., 2013; Cooke, Kavussanu, McIntyre, & Ring, 2011; Tauer & Harackiewicz, 2004). In contrast, people may experience anxiety, a negative emotion that is characterized by feelings of worry, which have been observed widely and showed to have a detrimental effect on performance (Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011; Cooke et al., 2010; Wilson et al., 2009; Wilson et al., 2006).

Although researchers have noted that other emotions, such as sadness, anger, and depression, can also affect performance (Vast, Young, & Thomas, 2010), only a few studies have looked at the effects of these negative emotions. Similarly, some positive emotions, such as excitement and amusement, have not been taken into consideration when exploring the emotion-performance relationship. As such, the present study explored more emotions that participants may experience in the competition to get a better understanding of the effects of emotion, and the emotion-performance relationship.

Effects of Competition on Effort

As well as performance and emotions, research on the effects of different types of competition has also focused on effort. It is highly associated with intrinsic motivation (Waterman, 2005), which is defined as the doing of activity for its inherent satisfactions rather than for some separate consequence (Ryan & Deci, 2000). In other words, intrinsic motivation affects how much time or effort individuals spend on developing their skills to increase their performance in competitions (Cooke et al., 2013; Tauer & Harackiewicz, 2004). Research has shown that intrinsic motivation is positively related to the improvement of performance (Cooke et al., 2013; Tauer & Harackiewicz, 1999). In the present study, intrinsic motivation was assessed to identify the influence of effort on performance was further examined under different types of reward interdependent competitions, to get a better understanding of its role in the change in performance.

Present Study

In the current study, reward interdependence was manipulated to be one of two levels, namely, high reward interdependence and low reward interdependence in a high task interdependence condition.

The first aim of the present study was to investigate the effects of high reward interdependence on performance, emotions, and effort in high task interdependent condition. The second aim was to assess further the effects of resource interdependence on performance, emotions, and effort. The third aim was to evaluate the interaction between resource interdependence and reward interdependence on performance, emotions, and effort. The fourth aim was to assess the relations among emotions, effort and performance.

Method

Participants

Forty-eight participants (32 male, mean age, 21.13 years, SD = 2.42; 16 female, mean age, 19.81 years, SD = 0.98) who were currently playing competitive sports gave informed consent and volunteered to participate in the study, which was approved by the research ethics committee of the University of Birmingham.

Measurements

Task performance. The number of baskets made was recorded and served as the primary measure of performance. The total number of throws attempted was also recorded. The percentage of baskets made (i.e., the number of baskets divided by the number of shots attempted) was computed to assess shooting accuracy. The total number of throws provided a behavioural measure of effort.

Emotion. Emotions were assessed using the Geneva emotion wheel (GEW; Scherer, 2005, Scherer, Shuman, Fontaine, & Soriano, 2013), and the intrinsic motivation inventory (IMI; Ryan, 1982). The GEW consists of 40 emotion words in 20 discrete emotion families (Figure 4.1). It gives participants more freedom to express their feelings by consisting of a free response format, a discrete emotion response format, and a dimensional approach to emotions (Sacharin, Schlegel, & Scherer, 2012). In this study, participants were asked to complete two wheels to describe how they felt at this moment in time towards their opponents and teammates

separately. The smallest ring stands for no emotion (coded 1), while the biggest ring (coded 5) stands for high level of emotion.

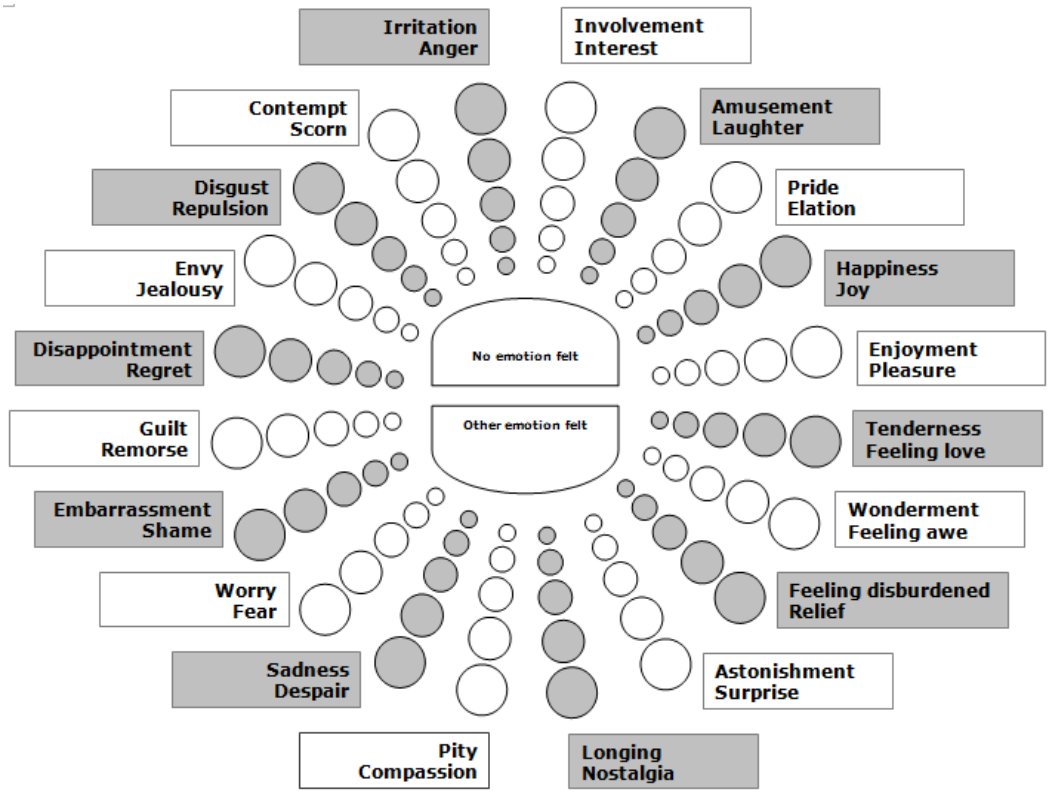


Figure 4.1. GEW with 40 Emotion Terms Arranged in 20 Emotion Families

The 5-item pressure and tension subscale and the 4 item interest and enjoyment subscale of the intrinsic motivation inventory (Ryan, 1982) were used to assess participants' feeling of pressure/tension and interest/enjoyment, respectively. Participants were asked to rate items, including ''I felt pressured'' and ''I felt very tense'' on a 7- point Likert scale (*1=not at all true, 4=somewhat true, 7=very true*). The item responses were averaged to provide one score for the scale.

Effort. In addition to the behavioural measure of effort (number of shots), we also assessed self-reported effort using effort subscale from the intrinsic motivation inventory (Ryan, 1982) by asking participants to rate items including "I put a lot of effort into this" and "I tried very hard on this activity" on a 7- point Likert scale (*1=not at all true, 4=somewhat true, 7=very true*).

Experimental Design

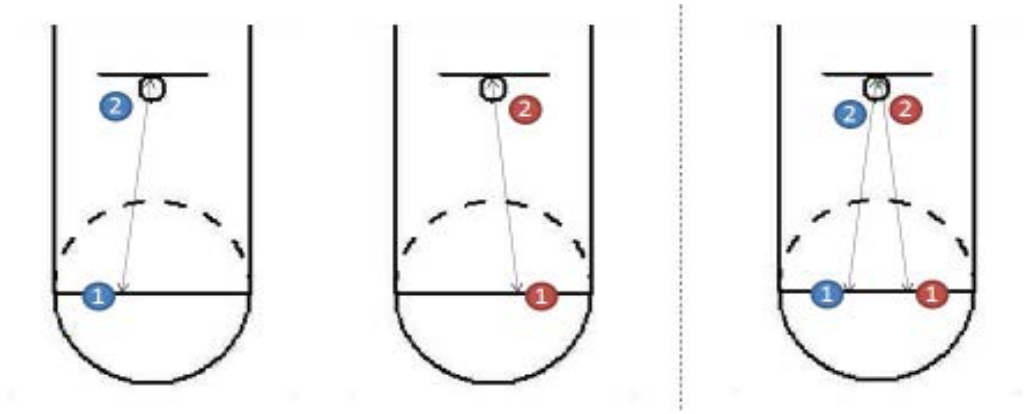
The study employed a mixed factorial design, with Task Condition (resource interdependent, resource independent) as the within-subjects factor, and Reward Condition (high reward interdependent, low reward interdependent) as the between-subjects factor.

Task

The aim of the basketball shooting and rebounding task was to make as many baskets as possible. The task was completed head-to-head by two teams of two participants. All four participants were the same gender and were not friends. One member of the team (the shooter) threw the ball to the hoop from a distance of 4.6 m whereas the second member of the team (the rebounder) rebounded, collected the ball, and handed it back to the shooter. The 8-minute task was divided into a series of four 2-minute periods. The role of each member of each team alternated every two minutes (i.e., team member one: shooter, rebounder, shooter, rebounder; team member two: rebounder, shooter, rebounder, shooter).

Task Conditions

Participants completed the basketball task in two counter-balanced task conditions (see Figure 4.2), with a 5-minute rest between conditions. In the means interdependent competition, the two shooters stood at the shooting position (0.6 m away from each other) and were asked to shoot towards the same basket (4.6 m away from the shooting position) at the same time. In this condition, the balls could collide in the air during shooting, and the rebounders could block each other. In the means independent competition, the two shooters stood at the shooting position (5.6 m away from each other) and were asked to shoot towards their own basket (4.6 m away from the shooting position and 5 m between the two baskets). In this condition, there was a minimal physical interaction between the opposing teams.



Resource interdependent condition Resource independent condition

Figure 4.2. Task Conditions

Reward Conditions

High reward interdependent condition. In the high reward interdependent condition ($N = 24$), the amount of reward that a participant could get relied on his/her performance compared with his/her teammate. If he/she performed better than his/her teammate, he/she was given more reward than his/her teammate. In the current study, 80% of the whole reward was given to the participant who performed better within the team, and the remaining 20% was given to the other participant.

Low reward independent condition. In the low reward interdependent condition ($N = 24$), the amount of reward that a participant could get was not dependent on his/her performance, which meant that no matter how good or how bad he/she performed, he/she still got the same amount of reward as his/her teammate. In other words, the reward was distributed equally to the two participants of the winning team (50% each).

Procedure

Participants completed a baseline screening test to assess their basketball shooting ability: they attempted 20 shots from the shooting position with no time constraint. Participants were then assigned to one of 12 different groups based on the

number of shots they made in the baseline test by sex. To make sure that all the participants from the same group had similar level of shooting skills, the number of shots that each participant made from baseline test was similar in each group (±1), and all four participants in each group confirmed that they were not friends of each other and randomly assigned into two teams. Both teams were informed that they were going to compete against each other for 8 minutes in two different competitive conditions, resource interdependent competition and resource independent competition. Participants completed both conditions in a counterbalanced order. The teams were told to try and make more baskets than their opponents. They were also told that they were not allowed to touch the other team's ball or physically interfere with the shooter.

A distribution method of the reward was randomly assigned to each group when it created. Participants were informed that a £5 reward would be given to the winning team in each competition, and the reward was distributed either equally (reward independently) or extremely (reward interdependently) to the two participants of the winning team. The number of baskets that each individual made was counted as the measure of their performance. If it was a draw, the number of shots was used to decide who performed better.

Before each task, all four participants completed a GEW. At the start of each competition, the highest scoring member of each team at baseline was the shooter and the lowest scoring member was the rebounder. In the case of a tied score, the starting roles were randomly determined. The two participants in each team swapped roles every two minutes. The shooting position of each team was randomly assigned at the start of the first task, counter-balanced across tasks, and switched half-way through

each task. At the end of the experiment, participants were thanked, debriefed, and asked not to disclose information about the experiment to others.

Statistical Analysis

A series of 2 Task Condition (resource interdependent, resource independent) by 2 Reward Condition (high reward interdependent, low reward interdependent) ANOVAs were conducted on the outcome variables (performance, emotion, and effort), and a series of 2 Task Condition (resource independent, resource interdependent) by 2 Time (before, after) ANOVAs were conducted on the effects of time on emotions. Post hoc tests explored significant interaction effects. Partial eta-squared is reported as a measure of effect size. Values of 0.02, 0.13 and 0.26 indicate small, medium and large effect sizes, respectively (Cohen, 1992). Finally, I used Judd, Kenny, & McClelland, (2001)'s difference/sum regression procedure to test within-subjects meditation.

Results

Performance

The 2 Task Condition × 2 Reward Condition ANOVA yielded a main effect of task condition on the number of baskets made, F (1, 46) = 10.82, $p < .01$, $\eta^2 = .19$, and the number of shots attempted, F (1, 46) = 25.64, $p < .001$, $\eta^2 = .39$. Performance was worse in the resource interdependent condition than the resource independent condition (see Figure 4.3).

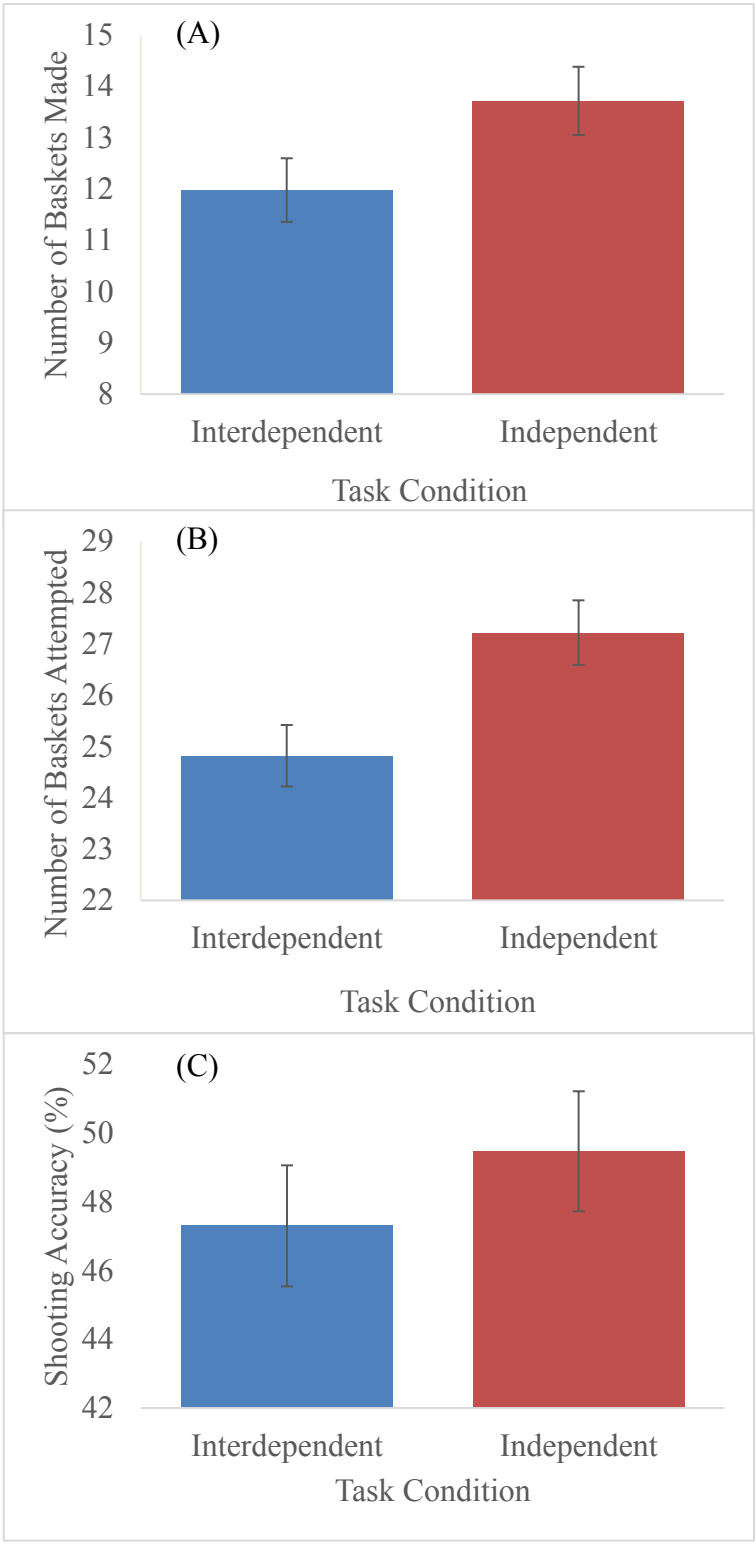


Figure 4.3. (A) The Number of Baskets made across Task Conditions. (B) The Number of Baskets Attempted across Task Conditions. (C) Shooting Accuracy across Task Conditions. Error bars depict standard error of the means.

However, there was no significant difference between reward independent competition and reward interdependent competition in the number of baskets made, F (1, 46) = .28, p = .87, η^2 = .001, the number of baskets attempted, F (1, 46) = 1.61, p =.21, η^2 = .03, and shooting accuracy, F (1, 46) = .60, p =.44, η^2 = .01.

The 2 Task Condition × 2 Reward Condition ANOVA also revealed a significant interaction effect between task condition and reward interdependence on the number of baskets attempted, F (1, 46) = 4.10, $p < .05$, η^2 = .08, but not on the number of shots made, F (1, 46) = 1.38, p = .65 η^2 = .004. Follow-up t tests revealed that the performance difference between the two task conditions (i.e., independent minus interdependent) were larger in the reward independent competition for the number of baskets attempted, t (46) = 2.03, $p < .05$, η^2 = .58 (see Figure 4.4).

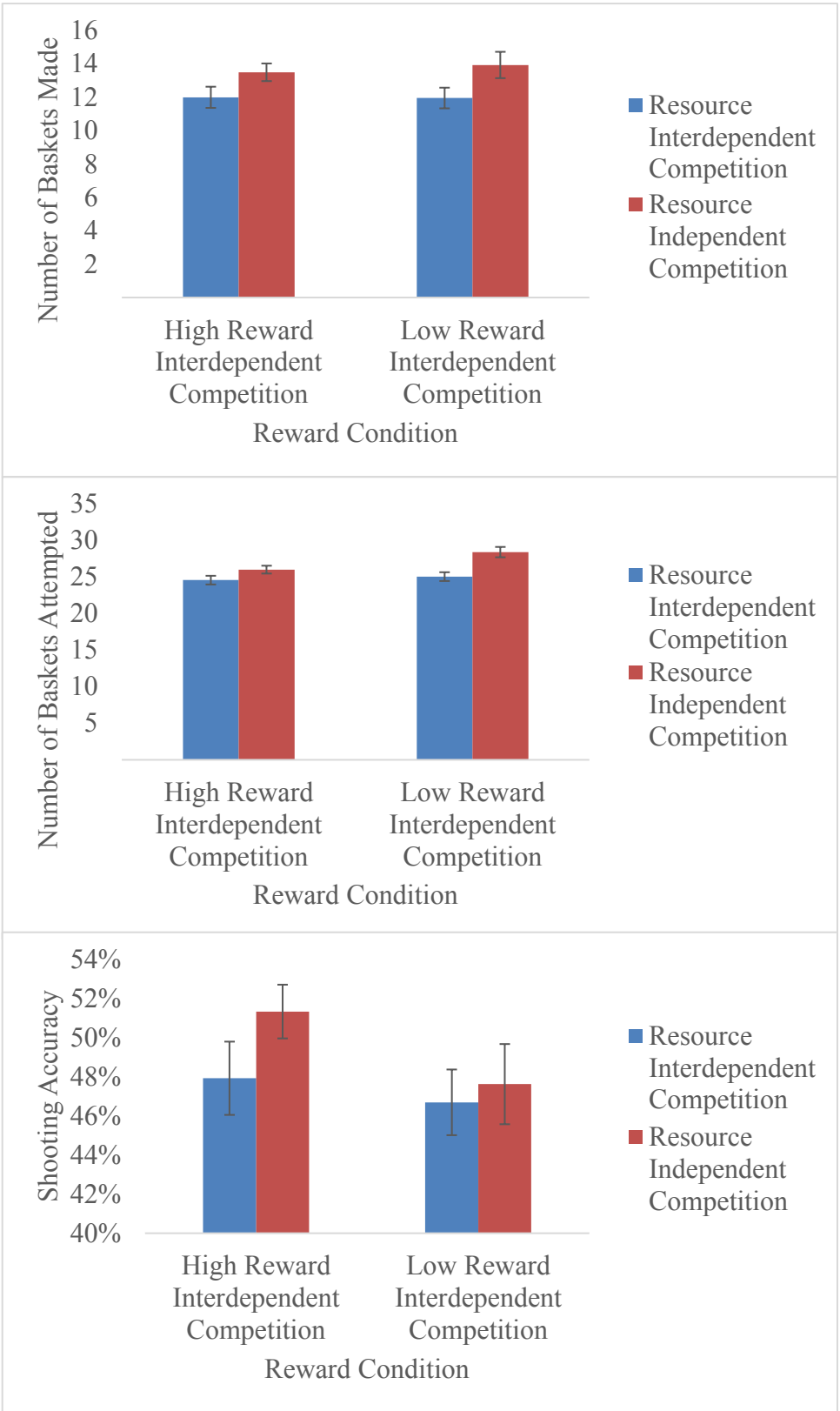


Figure 4.4. (A) Number of Baskets Made across Reward Conditions. (B) Number of Baskets Attempted across Reward Conditions. (C) Shooting Accuracy across Reward Conditions. Error bars depict standard error of the means.

Pressure, perceived competence, enjoyment and self-reported effort

The 2 Task Condition × 2 Reward Condition ANOVA revealed that participants felt they put more effort into the task during the resource independent competition. There were no main effects of resource independence or rewards interdependence on pressure, perceived competence, and enjoyment (see Table 4.1).

Table 4.1

Effects of Task Condition on Pressure, Perceived Competence, Enjoyment and Self-Reported Effort

	Resource Interdependent Competition		Resource Independent Competition				
Variable	*M*	*SD*	*M*	*SD*	$F(1,46)$	*p*	η^2
Pressure	2.61	1.06	2.77	1.10	2.61	.11	.05
Competence	4.37	1.22	4.52	1.17	2.07	.16	.04
Enjoyment	4.95	0.71	4.83	0.69	3.56	.07	.07
Self-Reported Effort	4.87	1.20	5.13	1.15	6.72	.01	.13

Emotion

The 2 Reward Condition (independent, interdependent) by 2 Task Condition (independent, interdependent) by 2 Time (before, after) repeated measures ANOVAs yielded main effects for time on the emotions, as assessed by the GEW: compared to the emotions before the task, participants felt more positive towards their opponents (see Table 4.2) and teammates (see Table 4.3) after the task.

Compared with their feelings before starting the competition, six (i.e. amusement, pride, happiness, enjoyment, wonderment and astonishment) out of ten positive emotions towards teammates were significantly increased, and all the effect sizes were moderate to large. Six (i.e. amusement, pride, happiness, enjoyment, relief and astonishment) out of ten positive emotion items towards opponents were significantly increased, and all the effect sizes were low to moderate. While one (i.e. worry) out of ten negative emotions towards their opponents and one (i.e. worry) out of ten negative emotions towards their teammates were significantly decreased.

The 2 Task Condition × 2 Reward Condition × 2 Time Point ANOVA also revealed interaction effects between task condition and time, and between reward condition and time. The difference of emotions was calculated (after task – before task), and analyzed by a 2 × 2 ANOVAs (task condition × reward condition). It showed that participants were more jealous towards their opponents (see Table 4.4) and more worried about their teammates under the reward independent condition (see Table 4.5).

Significant main effects of task condition were observed on two positive emotions. Participants were more amused by their opponents (see Table 4.6) and felt more astonishment towards their teammates during the resource interdependent competition (see Table 4.7).

Table 4.2

Emotions Towards Opponents Before and After the Task

	Before Task		After Task		ANOVA		
Variable	*M*	*SD*	*M*	*SD*	*F* (1,46)	*p*	η^2
Interest	2.94	1.41	2.96	1.69	.02	.88	<.001
Amusement	2.35	1.37	2.76	1.54	10.54	<.001	.19
Pride	2.08	1.18	2.53	1.60	14.07	<.001	.23
Happiness	2.48	1.43	2.82	1.39	8.11	.01	.15
Enjoyment	2.57	1.46	2.88	1.55	7.96	.01	.15
Tenderness	1.64	1.10	1.61	1.06	.08	.78	<.001
Wonderment	1.71	1.14	1.84	1.32	2.16	.15	.04
Relief	1.76	1.10	2.14	1.56	5.73	.02	.11
Astonishment	1.90	1.16	2.13	1.20	6.73	.013	.13
Longing	1.47	1.02	1.44	1.02	.46	.50	.01
Pity	1.50	0.79	1.68	1.10	3.62	.06	.07
Sadness	1.32	0.65	1.39	0.84	.65	.42	.01
Worry	1.77	0.87	1.38	0.84	15.80	<.001	.26
Embarrassment	1.43	0.79	1.35	0.78	.87	.36	.02
Guilt	1.28	0.63	1.27	0.72	.03	.86	<.001
Disappointment	1.33	0.75	1.50	1.07	3.24	.08	.07
Jealousy	1.50	0.80	1.63	0.99	2.29	.14	.05
Disgust	1.35	0.83	1.29	0.69	.63	.43	.01
Contempt	1.40	0.81	1.38	0.75	.07	.79	<.001
Anger	1.50	0.97	1.68	1.11	2.51	.12	.05

Table 4.3

Emotions Towards Teammates Before and After the Task

	Before Task		After Task		ANOVA		
Variable	*M*	*SD*	*M*	*SD*	*F* (1,46)	*p*	η^2
Interest	3.34	1.13	3.41	1.53	.45	.51	.01
Amusement	2.71	1.32	3.25	1.60	27.69	<.001	.38
Pride	2.64	1.32	3.42	1.48	45.00	<.001	.50
Happiness	2.80	1.28	3.50	1.31	48.36	<.001	.51
Enjoyment	2.73	1.33	3.37	1.40	36.65	<.001	.44
Tenderness	1.85	1.37	1.95	1.38	1.73	.20	.04
Wonderment	1.85	1.27	2.10	1.43	6.76	.01	.13
Relief	1.78	1.14	2.03	1.40	3.30	.08	.07
Astonishment	1.72	1.12	2.05	1.07	12.18	.001	.21
Longing	1.39	0.80	1.41	0.99	.19	.67	<.001
Pity	1.34	0.69	1.33	0.77	.03	.87	<.001
Sadness	1.31	0.66	1.33	0.86	.07	.79	<.001
Worry	1.48	0.78	1.27	0.70	9.06	.00	.16
Embarrassment	1.27	0.59	1.35	0.73	2.50	.12	.05
Guilt	1.21	0.55	1.30	0.77	1.71	.20	.04
Disappointment	1.27	0.63	1.42	0.87	3.77	.06	.08
Jealousy	1.33	0.76	1.32	0.75	.02	.90	<.001
Disgust	1.25	0.62	1.21	0.64	.60	.44	.01
Contempt	1.26	0.63	1.24	0.62	.11	.74	<.001
Anger	1.29	0.59	1.32	0.76	.20	.66	<.001

Table 4.4

Effects of Reward Condition on the Difference of Emotion Towards Opponents Before and After the Task

Variable	High Reward Interdependent Competition						Low Reward Interdependent Competition						ANOVA		
	Before		After		Difference		Before		After		Difference				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (1,46)	*p*	η^2
Interest	3.00	1.99	3.00	2.39	.00	1.21	2.88	1.99	2.92	2.39	.04	.51	.02	.88	<.001
Amusement	2.60	1.94	2.94	2.18	.33	.82	2.10	1.94	2.58	2.18	.48	.91	.34	.56	.01
Pride	2.38	1.67	2.77	2.26	.40	.98	1.79	1.67	2.29	2.26	.50	.64	.19	.67	<.001
Happiness	2.77	2.02	3.21	1.97	.44	.90	2.19	2.02	2.44	1.97	.25	.77	.60	.44	.01
Enjoyment	2.92	2.06	3.19	2.19	.27	.86	2.23	2.06	2.56	2.19	.33	.60	.09	.77	<.001
Tenderness	1.81	1.56	1.77	1.50	-.04	.55	1.46	1.56	1.46	1.50	.00	.47	.08	.78	<.001
Wonderment	1.94	1.62	2.13	1.86	.19	.72	1.48	1.62	1.56	1.86	.08	.55	.32	.58	.01
Relief	1.98	1.55	2.40	2.20	.42	1.13	1.54	1.55	1.88	2.20	.33	1.04	.07	.79	<.001
Astonishment	2.04	1.64	2.40	1.70	.35	.56	1.75	1.64	1.85	1.70	.10	.66	2.00	.16	.04
Longing	1.58	1.45	1.56	1.45	-.02	.40	1.35	1.45	1.31	1.45	-.04	.20	.05	.82	<.001
Pity	1.65	1.13	1.94	1.56	.29	.61	1.35	1.13	1.42	1.56	.06	.68	1.52	.22	.03
Sadness	1.46	.93	1.48	1.19	.02	.60	1.19	.93	1.29	1.19	.10	.47	.29	.59	.01
Worry	1.88	1.23	1.52	1.19	-.35	.80	1.67	1.23	1.23	1.19	-.44	.56	.18	.68	<.001
Embarrassment	1.58	1.12	1.52	1.11	-.06	.60	1.27	1.12	1.19	1.11	-.08	.48	.02	.90	<.001
Guilt	1.42	.89	1.38	1.02	-.04	.51	1.15	.89	1.17	1.02	.02	.28	.28	.60	.01
Disappointment	1.46	1.06	1.50	1.52	.04	.75	1.21	1.06	1.50	1.52	.29	.51	1.82	.18	.04
Jealousy	1.63	1.14	1.56	1.40	-.06	.56	1.38	1.14	1.69	1.40	.31	.59	5.15	.03	.10
Disgust	1.54	1.18	1.33	.97	-.21	.71	1.17	1.18	1.25	.97	.08	.32	3.41	.07	.07
Contempt	1.63	1.14	1.46	1.06	-.17	.67	1.17	1.14	1.29	1.06	.13	.37	3.49	.07	.07
Anger	1.60	1.36	1.67	1.57	.06	.86	1.40	1.36	1.69	1.57	.29	.67	1.05	.31	.02

Table 4.5

Effects of Reward Condition on the Difference of Emotion Towards Teammates Before and After the Task

Variable	High Reward Interdependent Competition						Low Reward Interdependent Competition						ANOVA		
	Before		After		Difference		Before		After		Difference				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (1,46)	*p*	η^2
Interest	3.38	1.59	3.42	2.17	.04	.69	3.31	1.59	3.40	2.17	.08	.60	.05	.83	<.001
Amusement	2.77	1.87	3.29	2.25	.52	.73	2.65	1.87	3.21	2.25	.56	.70	.04	.84	<.001
Pride	2.71	1.87	3.50	2.10	.79	.81	2.56	1.87	3.33	2.10	.77	.81	.01	.93	<.001
Happiness	2.90	1.81	3.71	1.86	.81	.70	2.71	1.81	3.29	1.86	.58	.69	1.30	.26	.03
Enjoyment	2.79	1.88	3.46	1.99	.67	.84	2.67	1.88	3.27	1.99	.60	.59	.09	.77	<.001
Tenderness	1.96	1.94	2.10	1.96	.15	.48	1.75	1.94	1.79	1.96	.04	.51	.54	.47	.01
Wonderment	2.00	1.80	2.21	2.02	.21	.75	1.71	1.80	2.00	2.02	.29	.57	.19	.67	<.001
Relief	1.94	1.61	2.38	1.98	.44	1.15	1.63	1.61	1.69	1.98	.06	.70	1.86	.18	.04
Astonishment	1.81	1.58	2.13	1.52	.31	.64	1.63	1.58	1.98	1.52	.35	.68	.05	.83	.00
Longing	1.44	1.15	1.54	1.40	.10	.42	1.33	1.15	1.27	1.40	-.06	.22	2.98	.09	.06
Pity	1.54	.96	1.46	1.10	-.08	.60	1.15	.96	1.21	1.10	.06	.22	1.24	.27	.03
Sadness	1.48	.93	1.46	1.21	-.02	.67	1.15	.93	1.21	1.21	.06	.37	.29	.60	.01
Worry	1.73	1.11	1.35	.98	-.38	.61	1.23	1.11	1.19	.98	-.04	.29	5.80	.02	.11
Embarrassment	1.42	.83	1.48	1.03	.06	.43	1.13	.83	1.23	1.03	.10	.29	.16	.70	<.001
Guilt	1.31	.77	1.42	1.10	.10	.61	1.10	.77	1.19	1.10	.08	.35	.02	.89	<.001
Disappointment	1.35	.89	1.48	1.23	.13	.61	1.19	.89	1.35	1.23	.17	.41	.08	.78	<.001
Jealousy	1.46	1.08	1.38	1.07	-.08	.65	1.21	1.08	1.27	1.07	.06	.52	.73	.40	.02
Disgust	1.33	.87	1.31	.90	-.02	.50	1.17	.87	1.10	.90	-.06	.17	.15	.70	.00
Contempt	1.35	.89	1.35	.88	.00	.59	1.17	.89	1.13	.88	-.04	.14	.11	.74	.00
Anger	1.44	.83	1.42	1.08	-.02	.63	1.15	.83	1.23	1.08	.08	.28	.54	.47	.01

Table 4.6

Effects of Task Condition on the Difference of Emotion Towards Opponents Before and After the Task

Variable	Resource Interdependent Competition						Resource Independent Competition						ANOVA		
	Before		After		Difference		Before		After		Difference				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (1,46)	*p*	η^2
Interest	3.06	1.02	2.94	1.10	.13	1.64	2.98	.93	2.81	1.05	-.08	1.79	.85	.36	.02
Amusement	2.38	1.00	2.88	1.08	.79	1.71	2.52	1.13	2.35	1.16	.02	1.48	13.42	<.001	.23
Pride	1.94	.84	2.08	1.03	.48	1.38	1.96	1.05	1.94	1.12	.42	1.55	.12	.73	<.001
Happiness	2.44	.94	2.54	1.11	.42	1.55	2.40	1.09	2.17	1.10	.27	1.55	.51	.48	.01
Enjoyment	2.48	1.07	2.81	1.10	.29	1.53	2.58	1.05	2.48	1.11	.31	1.32	.01	.92	<.001
Tenderness	1.42	.68	1.46	.71	.04	1.10	1.46	.68	1.33	.63	-.08	.87	.80	.38	.02
Wonderment	1.60	.82	1.77	.83	.23	1.32	1.69	.88	1.65	.84	.04	1.14	1.19	.28	.03
Relief	1.65	.84	1.75	.96	.33	1.72	1.85	1.05	1.73	.94	.42	1.86	.19	.66	<.001
Astonishment	1.71	.94	2.21	1.03	.29	1.18	1.79	.85	1.90	.99	.17	1.19	.58	.45	.01
Longing	1.40	.61	1.27	.57	-.04	.66	1.33	.60	1.23	.56	-.02	.75	.04	.85	.00
Pity	1.44	.62	1.46	.82	.23	1.26	1.33	.60	1.40	.74	.13	1.17	.40	.53	.01
Sadness	1.27	.57	1.33	.60	.10	.99	1.31	.59	1.23	.47	.02	1.00	.41	.53	.01
Worry	1.94	.89	1.27	.57	-.54	1.16	1.60	.89	1.35	.70	-.25	1.35	3.26	.08	.07
Embarrassment	1.44	.80	1.48	.71	-.08	.97	1.44	.77	1.33	.66	-.06	1.04	.02	.88	<.001
Guilt	1.27	.57	1.27	.54	-.02	.54	1.29	.50	1.19	.45	.00	.78	.09	.77	<.001
Disappointment	1.35	.53	1.42	.77	.21	1.14	1.27	.54	1.33	.63	.13	1.00	.51	.48	.01
Jealousy	1.54	.82	1.60	.94	.02	1.29	1.44	.74	1.56	.90	.23	1.05	1.42	.24	.03
Disgust	1.27	.61	1.15	.36	-.06	.86	1.23	.56	1.10	.31	-.06	.78	.00	1.00	<.001
Contempt	1.42	.74	1.35	.64	.00	1.06	1.40	.64	1.33	.66	-.04	.82	.13	.72	<.001
Anger	1.50	.74	1.48	.85	.17	1.33	1.48	.80	1.52	.85	.19	1.34	.02	.89	<.001

Table 4.7

Effects of Task Condition on the Difference of Emotion Towards Teammates Before and After the Task

Variable	Resource Interdependent Competition						Resource Independent Competition						ANOVA		
	Before		After		Difference		Before		After		Difference				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (1,46)	*p*	η^2
Interest	3.38	.98	3.42	1.16	.04	1.14	3.31	.78	3.40	1.20	.08	1.34	.06	.81	.00
Amusement	2.56	1.15	3.25	1.19	.69	1.47	2.85	.99	3.25	1.19	.40	1.21	2.59	.11	.05
Pride	2.56	1.11	3.48	1.13	.92	1.55	2.71	1.11	3.35	1.10	.65	1.38	2.08	.16	.04
Happiness	2.85	1.11	3.44	1.07	.58	1.29	2.75	1.00	3.56	.99	.81	1.27	1.87	.18	.04
Enjoyment	2.67	1.19	3.21	1.05	.54	1.21	2.79	.94	3.52	1.07	.73	1.40	1.27	.27	.03
Tenderness	1.90	1.12	1.94	1.04	.04	.88	1.81	1.00	1.96	1.03	.15	.97	.71	.41	.02
Wonderment	1.79	.99	2.04	1.05	.25	1.19	1.92	1.01	2.17	1.10	.25	1.36	.00	1.00	<.001
Relief	1.67	.83	2.06	1.19	.40	1.49	1.90	.97	2.00	1.11	.10	1.62	3.42	.07	.07
Astonishment	1.54	.82	2.08	.96	.54	1.39	1.90	.93	2.02	.93	.13	1.22	4.94	.03	.10
Longing	1.35	.57	1.40	.74	.04	.66	1.42	.68	1.42	.74	.00	.56	.28	.60	.01
Pity	1.38	.61	1.38	.67	.00	.92	1.31	.55	1.29	.58	-.02	.69	.04	.84	<.001
Sadness	1.29	.50	1.33	.69	.04	1.02	1.33	.56	1.33	.60	.00	.77	.17	.68	<.001
Worry	1.52	.80	1.31	.62	-.21	1.06	1.44	.54	1.23	.47	-.21	.70	.00	1.00	<.001
Embarrassment	1.27	.57	1.31	.59	.04	.83	1.27	.45	1.40	.64	.13	.81	.41	.53	.01
Guilt	1.19	.45	1.27	.61	.08	.76	1.23	.43	1.33	.66	.10	.99	.04	.85	<.001
Disappointment	1.21	.46	1.46	.74	.25	.95	1.33	.56	1.38	.64	.04	.92	3.07	.09	.06
Jealousy	1.27	.57	1.31	.55	.04	.77	1.40	.77	1.33	.60	-.06	1.22	.74	.39	.02
Disgust	1.21	.46	1.21	.46	.00	.58	1.29	.50	1.21	.50	-.08	.65	1.72	.20	.04
Contempt	1.21	.46	1.25	.48	.04	.65	1.31	.55	1.23	.52	-.08	.82	2.09	.15	.04
Anger	1.23	.52	1.33	.60	.10	.94	1.35	.57	1.31	.59	-.04	.92	1.31	.26	.03

Mediators of the Effects of Task Condition on Performance

The ANOVAs reported above indicated that performance increased from resource interdependent competition to resource independent competition. To further test whether the difference of performance was mediated by the difference of effort and emotions, I used Judd, Kenny, & McClelland, (2001)'s difference/sum regression to test mediation in with-in subject design. More specifically, I regressed the difference in the number of baskets made and the number of baskets attempted on the differences and sum in pressure, competence and self-reported effort. Mediation can be inferred if the difference in effort and emotion predicts the difference in performance.

When the difference on the number of baskets attempted (A_D) was regressed on the self-reported effort sum (E_S) and difference (E_D), $A_D = 3.50 + 1.59E_D - 0.15E_S$, the self-reported effort difference was a significant predictor of the difference on the number of baskets attempted, t (44) = 2.25, $p < .05$, but the self-reported effort sum was not. The residual difference was not significant ($p = .13$). These findings suggested that self-reported effort fully mediated the improvement in the number of baskets attempted from the resource interdependent condition to the resource independent condition.

In addition, these analyses revealed that the difference in self-reported effort was also a significant predictor of the difference in the number of baskets made (M_D), $M_D = 1.89 + 2.21E_D - 0.06E_S$, t (44) = 3.11, $p < .01$, where the self-reported effort sum was not. Because the residual differences in the number of baskets made were not significant ($p > .41$). Self-reported effort then fully mediated the difference in the number of baskets made.

Discussion

The Effects of Reward Interdependence

The first aim of this study was to investigate the effects of high reward interdependence on performance, emotions, and effort in a high task interdependent situation. The results showed that there was no difference in performance between the high reward interdependent condition and the low reward interdependent condition. It partially supported Allen, Sargent, and Bradley's (2003) findings, who reported that high reward interdependence had no significant effects on performance and self-reported effort. It might be because the task in the current study was both skills-based and effort-based, and therefore the average skill level of the team might have prevented high reward interdependence from facilitating performance. Allen, Sargent, and Bradley (2003) stated that when task interdependence was high, the average skill or knowledge level of the team might be crucial to performance. As the task became more complex, the gap between the required skill and task complexity was larger. It was then less likely that reward interdependence would improve performance. In the current study, all of the participants performed similarly in the baseline test, which indicated that their ability of shooting was similar. Because there were no training or instructions to improve their skill level, the gap between this average skill level and task complexity stayed consistent throughout the task. In this study, this gap might have been too large for reward interdependence to influence performance.

Additionally, Bonner et al. (2000) argued that only the individual with the required skill and/or knowledge to complete the task could translate increased effort into improved performance. This was more likely to occur when the performance was skill-based. Although the high reward interdependence might increase effort, because of the low skill levels of participants, it was less likely that the performance would be

maximized. Future studies might need to recruit participants with high skill levels to reduce the gap between average skill level and task complexity, to get a clearer effect of high reward interdependence on performance.

Moreover, compared to the low reward interdependent condition, participants reported that two negative emotions, jealousy towards opponents and worry towards teammates, were significantly reduced after doing the task under the high reward interdependent condition. In the current study, the reward was only given to the team who won the competition against another team. As a result, the losing team might have felt more jealous towards their opponents, and this effect was larger under low reward interdependence condition. It might be because under high reward interdependence condition the reward of one game was distributed as £4, £1, £0, £0. Three-quarters of participants received a similar level of prize, which may have led to a closer identity of these three participants, and resulted in a lower level of negative emotion (e.g., jealousy) towards each other. In contrast, half of the participants received a prize while the other half received nothing. Although the total amount of the reward was the same as the other reward condition, participants from both the losing team and the winning team would have a clear identity on their own sides, which tends to result in a more negative feeling in the team without reward (Salvador, Serrano, & Ricarte, 1999).

Participants worried more about their partners in the high reward interdependence condition. Because the amount of reward that a participant could get highly depended on their partners' performance, if their partner performed well, they might worry about the loss of the bigger portion of the reward. At the same time, if their partner performed poorly, they might worry about the loss of the team competition. This might have affected participants' attention on the task and reduced

the available cognitive resources needed to complete the task. Some researchers have reported similar results in their studies (Wilson, Vine, & Wood, 2009; Wilson et al., 2006), whereby negative emotions, such as anxiety, adversely affected performance. In this study, high task interdependence led to more cooperative behaviour within the team, which was beneficial for performance. However, the high reward interdependence, to some extent, created a competition inside the team, which resulted in an opposite effect to cooperation. Similarly, Moser and Wodzicki (2007) stated that high task interdependence might create ceiling effects regarding the influence of high reward interdependence. They argued that when the task was high in task interdependence, participants were forced to share their knowledge or help each other more, to win the reward at the end. As a result, the effects of high reward interdependence on improving personal performance was limited. Hence participants' overall performance was not promoted by the high reward interdependence in the high task interdependent competition. In light of this, it seems that the effects of high reward interdependence were highly dependent on the level of task interdependence.

The Effects of Resource Interdependence

The second aim was to assess the effects of resource interdependence on performance, emotions, and effort. The results partially supported my previous study (see Study 2 of this thesis). In the current study, participants attempted and made more baskets under the resource independent condition. Because compared to the resource interdependent condition, there was less interruption between two groups, participants had more chances to shoot more baskets and make more baskets. However, in the previous study, shooting accuracy was also significantly increased under the resource independent condition, which was not observed in this study. This may be because participants' skill levels were mixed in the previous study, which gave those who

performed badly in the baseline test an opportunity to learn and improve their skills while doing the competition. This effect was larger under resource independent condition because participants could concentrate more on learning and copying the skill from their partners with less interruption from their opponents. As a result, participants' shooting skill improved, especially for those ranked bottom in the baseline test, which led to a significant increase in shooting accuracy. In contrast, the participants' skill level was similar in the current study. They were all ranked in the middle part of the baseline test. Therefore, it was harder for them to obtain useful information from their teammates to improve their skill level while performing in the competition, which created a ceiling effect to improve their skill-based performance, i.e. shooting accuracy.

Compared to the resource interdependent condition, participants thought they put more effort into the task under the resource independent condition, and they tended to feel more pressure, more competence, and less enjoyment. Many researchers have evaluated the relation between effort and performance (Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011; Cooke, Kavussanu, McIntyre, & Ring, 2013). Previous research has found that self-reported effort partially mediated the improvement in participants' putting accuracy (Cooke, Kavussanu, McIntyre, Boardley, et al., 2011) and handgrip endurance time (Cooke et al., 2013). The current study corroborated these findings, whereby the difference in self-reported effort between the resource interdependent condition and the resource independent condition mediated the effects of condition on the number of baskets made and the number of baskets attempted. With one more unit difference on self-reported effort, participants attempted 2.21 more baskets and made 1.59 more baskets. It seems that participants allocated additional attention to the task when they thought they were putting more

effort into the task (Cooke, Kavussanu, McIntyre, Boardley, et al., 2011). This might lead to a faster reaction time, a more steady position, and a more efficient movement. This effect was stronger when the activity was effort-based, with very low level of skills involved (Cooke et al., 2013). When the activity was highly skill-based, the improvement caused by the increase of effort was always not strong enough to influence skill-based performance due to the lack of adequate skill level. Cooke, Kavussanu, McIntyre, Boardley, et al., (2011) found similar results in their study, whereby participants' mean radial error in a putting task was better when self-reported effort increased, however, there was no improvement in the number of putts holed. Both putting radial error and the number of putts holed were a measure of skill-based performance. However, the way to make a statistically increase in these two types of measurements were different. For example, with a higher skill level, participants could putt a ball from 10 cm radial error to 5 cm radial error to make their performance statistically improved, but there would be no difference on the number of putts holed. In other words, it was easier for participants to improve their performance on the mean radial error, because it required a lower skill level than improving their performance on the number of putts holed. Similarly, in the current study, shooting accuracy and the number of baskets made both measured skill-based performance. However, shooting accuracy would not change with the increased number of baskets attempted, which the number of baskets made might do. It made the number of baskets made a mix (both effort and skill based) measurement of performance. As a result, participants required a higher level of skills to make their shooting accuracy statistically improved, while they needed a lower skill level to improve the number of baskets made because of the raised number of baskets attempted. Therefore, future

studies might need to consider more about the influence of participants' skill level on different types of performance measurements.

The Interaction Effects of Task Condition and Teward Condition

The third aim of this study was to compare the effects of resource interdependence and reward interdependence on performance, emotions, and effort. The results showed that, compared to the high reward interdependent condition, the difference between the resource interdependent condition and resource independent condition in the number of baskets attempted was larger under the low reward interdependent condition. This is in line with the study by Fan and Gruenfeld (1998). They tested the interaction between resource interdependence and reward interdependence in a card playing task. In their study, they manipulated resource interdependence within the group, and found that the effects of different levels of reward interdependence were absent when resource interdependence was high. Because the task interdependence was high in the current study, this suggests that the effects of task interdependence and resource interdependence were very similar within the group.

Other studies in the context of education and business all reported that high task or resource interdependence within the group prevented high reward interdependence from motivating the performance (e.g. Allen et al., 2003; Fan & Gruenfeld, 1998; Moser & Wodzicki, 2007; Wageman & Baker, 1997). However, in the current study, resource interdependence was manipulated between the groups, and, therefore, this was the first study to evaluate the effect of resource interdependence between the groups and the interaction with reward interdependence.

Because the number of baskets attempted was a measure of effort-based performance, when completing the resource independent task, participants put more

effort under the low reward interdependent condition. This result was partially consistent with Allen and his colleagues' (2003) research, who found that helping behaviour, but not performance, was highest under the combination of high task interdependence and low reward interdependence. They argued that if task interdependence and reward interdependence were not at the same level, it was likely to lower the standard of the output and might produce more mistakes, even though it might produce a higher number of outputs. In other words, it seems that low reward interdependence had an effect on effort-based performance, such as the number of baskets shot and helping behaviour, but not on skill-based performance, such as shooting accuracy and the number of wrong corrections. In the current study, the interaction effect was larger under group low resource interdependent condition. According to social interdependence theory (Deutsch, 1949; Stanne et al., 1999), positive social interdependence would be most effective on groups' outcome when the rewards were distributed equally to each group members. However, it seems that the consequences or the performance could be further categorized into skill-based and effort-based, and the effects of social interdependence might be different depending on the different types of performance.

Limitations and Future Directions

There are some limitations of this research that need to be considered when interpreting these findings. First, the experiment took place outdoors. In this circumstance, participants' shooting performance might have been influenced by the weather, i.e. wind, rain. It was a rare occasion as the experiment would only be conducted when the rain possibility was under 30% in the forecast. However, on one occasion it started to rain heavily all of a sudden,and so participants had to stop and wait for the weather to improve to complete the task. So participants would

experience less interference if the experiment was conducted indoors. Second, the reward might not have been big enough to create a competitive environment within and between groups. Although the small reward had an effect on effort-based performance and negative emotions, participants acted fairly to each other when doing the task. Future studies could create a more competitive task with a larger reward to find out whether the effect of the reward has a greater effect on the outcome measures. Third, the baseline test might not have provided a good assessment to characterize the participants and allocate them to groups. Future studies should find out a better way, such as add another baseline test or add a do your best session, to more fully assess the skill level of participants. With this in place, only participants with suitable skill levels could be involved in the research.

It would be interesting for future research to add measures of attentional control, such as eye gaze analysis (M. R. Wilson et al., 2009), which was used to examine the relationship between anxiety and performance. Future studies could also obtain physiological measures, such as heart rate (Zanten et al., 2002), which can provide a more detailed insight into the relationship between anxiety and performance. Finally, future studies could also test the effects of different group sizes on different types of team competition. Because the effects of social loafing were stronger with larger group sizes (e.g. Karau, Williams, Bourgeois, Carlston, & Eagly, 1993), larger groups might reduce the feeling of enjoyment and effort contributed into the task. Therefore, it would be worth to find out the optimal group size to improve participants' performance.

Conclusion

In conclusion, the current study provided evidence to indicate that the effects of different levels of between-team resource interdependence and reward

interdependence in a high task interdependent task differentially influenced both skill-based performance and effort-based performance. Moreover, the results showed that increased self-reported effort mediated the improvement in skill-based performance. The findings partially supported the intrinsic motivation mechanisms (Tauer & Harackiewicz, 1999), in which self-reported effort and competence mediated the change in enjoyment, and where enjoyment was a key mediator of the change in performance. However, the effects of enjoyment on performance were not replicated in the current study. Furthermore, the results suggested that the effects of different types of competition might be different depending on different types of performance. Future research should continue to examine the effects of reward interdependence in a pure skill-based activity or a pure effort-based activity, to get a better understanding of the effects of reward interdependence on performance, effort, and emotions.

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Chapter 5: The Effects of Within-Team Reward Interdependence on Effort-Based Performance, Emotion, and Self-Reported Effort in Team Competition

Abstract

Many studies have looked at the effects of team competition on motor performance. Due to the lack of clear classification of different types of competition, the mechanism behind the competition-performance relationship is still unclear. Social interdependence theory provides a framework that explains the way a task is structured. By identifying the effects of certain type of interdependence, it can lead to a better way to clarify different types of competition and a better understanding of the nature of competition. The current experiment examined the effects of reward interdependence on performance, emotions, and self-reported effort in an effort-based task in a four-on-four team competition. 110 males and 62 females were involved in the handgrip task. Results showed that compared to the no reward condition, the performance was significantly better under both high reward interdependent condition and low reward interdependent condition. The mediation analysis indicated that self-reported effort and pressure partially mediated the increase in performance from the no reward condition to the high reward interdependent condition, whereas enjoyment, pride, wonderment and relief towards teammates all partially mediated the increase in the total % MVC from the no reward condition to the low reward interdependent condition. These findings further supported the use of social interdependence theory on clarifying and understanding the effects of different types of competition on motor performance.

Introduction

It is well established that different types of competition might have different effects on performance (Cooke, Kavussanu, McIntyre, & Ring, 2013, 2011; Johnson & Johnson, 2005). According to social interdependence theory, competition was consist of different types of social interdependence (Johnson, 1999; Johnson & Johnson, 2005). Reward interdependence is one important type of outcome interdependence (Johnson & Johnson, 2005) and has been examined in many studies (e.g. Allen, Sargent, & Bradley, 2003; Buchs, Gilles, Dutrévis, & Butera, 2011; Wageman & Baker, 1997). However, previous studies, for the most part, have not tested the effects of reward interdependence on motor performance, and also have failed to test the effects of high reward interdependence in a high effort-based task. As a consequence, our understanding of the effects of reward interdependence on motor performance is limited. This study investigated the effects of high reward interdependence on performance, emotion, and effort in an effort-based task, to further explore the relationship between different types of reward interdependent competition and performance.

Effects of Reward Interdependence on Performance

According to Johnson and Johnson (2005), reward interdependence was defined as the extent to which the reward an individual can get depends on the performance of others. Low reward interdependence exists when people received a reward regardless their performance in the group, such as appearance money. In contrast, high reward interdependence exists when people received a reward completely based on their performance in the group, such as performance related pay (Wageman, 1995). The effects of high reward interdependence have been examined in education and work settings. Positive effects of high reward interdependence on

performance were found in many studies (DeMatteo, Eby, & Sundstrom, 1998; Moser & Wodzicki, 2007), whereas others found no effects (Allen et al., 2003). Specifically, Moser and Wodzicki (2007) compared low reward interdependence and high reward interdependence under a low-to-moderate task interdependence condition and found that high reward interdependence acted as an effective incentive to promote team cooperation and information sharing when task interdependence was low or moderate. However, in Allen and his colleagues' (2003) copywriting studies, no significant effects of either task interdependence nor reward interdependence on performance.

Some researchers (e.g. Allen et al., 2003) claimed that when task interdependence was high, the gap between the task complexity and the average skill level to complete the task might be larger, which would prevent the high reward interdependence from promoting the performance. Moser and Wodzicki (2007) stated that high task interdependence might result in ceiling effects for individuals` improvement by forcing them to share their knowledge or help each other more. In chapter 4 of this thesis, the effects of reward interdependence were tested on both effort-based performance (e.g. the number of baskets attempted) and skill-based performance (e.g. shooting accuracy). Low reward interdependence was found to motivate effort-based performance under the high task interdependent condition. Therefore, the current study assessed different reward conditions in an effort-based task in a low task interdependent condition to minimize the influence of skill level on the effects of reward interdependence, and further improve our understanding of the way in which reward interdependence may affect people's performance.

Emotions and Performance

People might experience both positive and negative emotions during a competition. On the one hand, people might experience more enjoyment during

competition (Cooke et al., 2013; Tauer & Harackiewicz, 2004), which could encourage them to put more effort into the task and lead to a better performance (Cooke, Kavussanu, McIntyre, & Ring, 2010; Wilson, Smith, Chattington, Ford, & Marple-Horvat, 2006). On the other hand, research has revealed that negative emotions, i.e. anxiety, might be adverse to performance under competition (Wilson, Vine, & Wood, 2009; Wilson et al., 2006).

Tauer and Harackiewicz (2004) conducted four field experiments with a skill-based basketball free throw task. They found that enjoyment and basketball shooting performance was increased in competition. The mediation analysis from their study also showed that enjoyment was partially responsible for the promotion of performance. Cooke and his colleagues (2013) found similar results in their isometric endurance task. They reported that self-reported enjoyment fully mediated the difference on performance between different types of competitions.

Wilson and his colleagues (2009) reported negative effects of anxiety on shooting accuracy and gaze behaviour in their basketball free throw shooting task. In line with processing efficiency theory (Eysenck & Calvo, 1992; Eysenck, Derakshan, Santos, & Calvo, 2007), they claimed that the impairment on performance was likely due to the disruption in attentional control. However, because the negative influence of anxiety was predicted to be more significant on processing efficiency than on performance effectiveness, the negative effects of anxiety can be compensated by investing additional effort and attention into the task (Eysenck & Calvo, 1992).

Vast, Young, and Thomas (2010) stated that other negative emotions, such as sadness, anger, and depression, which have not been widely studied could also affect performance. Similarly, positive emotions, such as excitement and amusement, were also worth to be taken into consideration when exploring the emotion-performance

relationship. Therefore, the current study further investigated the effects of positive emotion and negative emotion on performance to get a better understanding of the emotion-performance relationship under different types of competition.

Self-Reported Effort and Performance

Many studies have found that self-reported effort was positively related to the improvement of performance (Cooke et al., 2013; Tauer & Harackiewicz, 2004). Self-reported effort is highly associated with intrinsic motivation (Waterman, 2005), which affects how much time or effort individuals spend on developing their skills to increase their performance in competitions (Cooke et al., 2013; Tauer & Harackiewicz, 2004). Previous studies have found that with increased self-reported effort, the effort-based performance was promoted, e.g. the number of baskets attempted (see Chapter 4 in this thesis) and the grip endurance time (Cooke et al., 2013). Despite this, Cooke et al., (2013) have revealed the mediation effects of self-reported effort on the performance difference between different types of competitions, which was supported by my previous study (see Chapter 4 in this thesis). It seems that the mediation effects of self-reported effort were limited on skill-based performance (e.g. shooting accuracy), in which only individuals with the required skill and/or knowledge to complete the task could translate increased effort into improved skill-based performance (Bonner, Hastie, Sprinkle, & Young, 2000).

Cooke et al., (2013) also found that the increased anxiety and enjoyment was partially mediated the increased self-reported effort, respectively. It was consistency with the processing efficiency theory, in which performance can be improved by increased anxiety through allocating more effort into the task (Eysenck & Calvo, 1992). However, the mediation effects of other emotions on self-reported effort were seldom investigated.

In the present study, the influence of self-reported effort on performance was further examined under different types of reward conditions, to get a better understanding of its role in the change in performance.

Present Study

In the current study, the reward interdependence was manipulated into three levels, no reward, high reward interdependence, and low reward interdependence in a low task interdependent effort-based task.

Informed by previous research, the first aim of the present study was to investigate the effects of high reward interdependence on effort-based performance, emotions, and self-reported effort in low task interdependent condition. The second aim was to find out the mechanism underlying the performance by assessing the mediating roles of emotions, self-reported effort on performance and the mediating roles of emotions on the self-reported effort.

Method

Participants

One hundred and seventy-two students (110 male; 62 female) enrolled in an undergraduate sports science course gave informed consent and volunteered to participate in the study, which was approved by the research ethics committee of the University of Birmingham.

Measurements

Task performance. The total % MVC was recorded and served as the measure of performance.

Emotion. Emotions were assessed using the Geneva emotion wheel (GEW; Scherer, 2005, Scherer, Shuman, Fontaine, & Soriano, 2013) , and the intrinsic motivation inventory (IMI; Ryan, 1982).

The GEW consists of 40 emotion words in 20 discrete emotion families (see Figure 5.1). It gives participants more freedom to express their feelings by consisting of a free response format, a discrete emotion response format, and a dimensional approach to emotions (Sacharin, Schlegel, & Scherer, 2012). In this study, participants were asked to complete two wheels to describe how they felt at this moment in time towards their opponents and teammates separately. The smallest ring stands for no emotion (coded 1), while the biggest ring (coded 5) stands for high level of emotion.

The 5-item pressure and tension subscale and the 4 item interest and enjoyment subscale of the intrinsic motivation inventory (Ryan, 1982) were used to assess participants' feeling of pressure/tension and interest/enjoyment, respectively. Participants were asked to rate items, including ''I felt pressured'' and ''I felt very tense'' on a 7- point Likert scale (1 = *not at all true,* 4 = *somewhat true,* 7 = *very true*). The item responses were averaged to provide one score for the scale.

Self-reported effort. Self-reported effort was assessed using 5-item effort subscale from the intrinsic motivation inventory (Ryan, 1982) by asking participants to rate items including "I put a lot of effort into this" and "I tried very hard on this activity" on a 7- point Likert scale (1 = *not at all true*, 4 = *somewhat true*, 7 = *very true*).

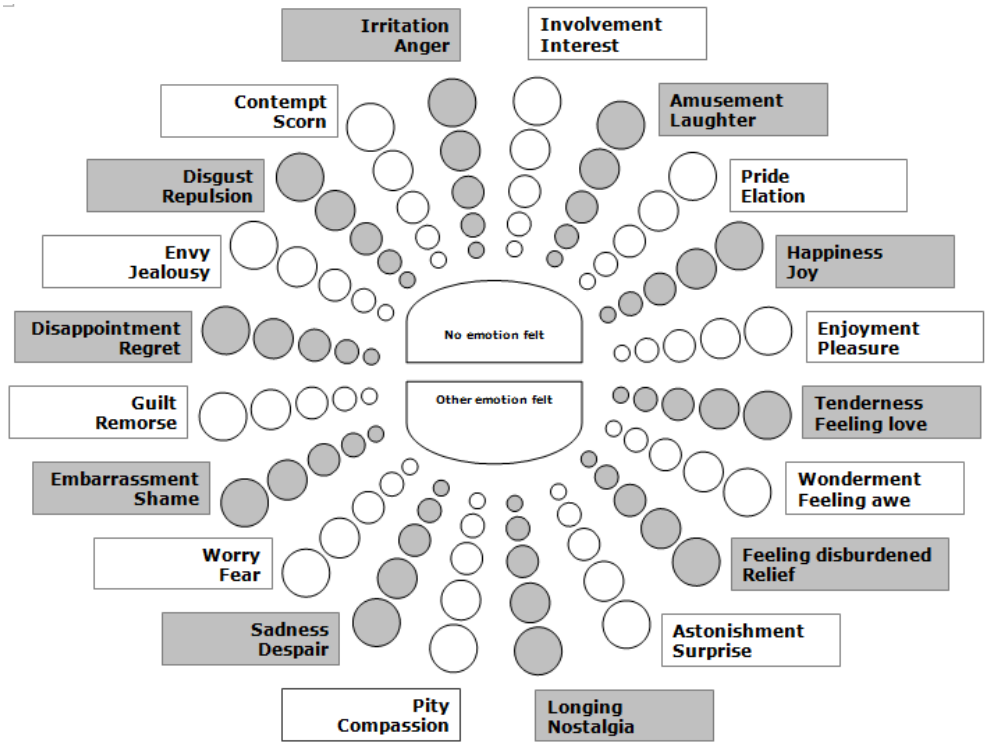

Figure 5.1. GEW with 40 Emotion Terms Arranged in 20 Emotion Families

Task ratings. At the end of each competition, participants rated on a 7-point Likert scales (0 = *not at all*; 6 = *extremely*) how competitive, cooperative, difficult, engaging, important, cohesive, and conflict-ridden they have found the previous handgrip task.

Experimental Design

The study employed one within-subjects factor, Reward Condition, with three different levels: no reward, high reward interdependent, and low reward interdependent.

Task

The handgrip task required participants to squeeze a handgrip dynamometer (Radwin, Masters, & Lupton, 1991) continuously for 3 minutes, with the goal to produce the largest cumulative total percentage of maximal voluntary contraction (total % MVC). The task was completed head-to-head by two teams of four participants. All eight participants were the same gender. Participants were seated upright and used their dominant hand to hold the dynamometer (see Figure 5.2). A large monitor (dimensions = 112.6 cm x 65.2 cm) was positioned opposite all the participants to display each individual's % MVC per second and total % MVC by their seat number. Their total team % MVC was also shown in the middle of the screen along with the task time. The score of the two teams were displayed in two different colours, red and blue. Participants were asked to produce higher team total % MVC than the other team to win the competition. The grip force was monitored and recorded by a computer running Spike2 software.

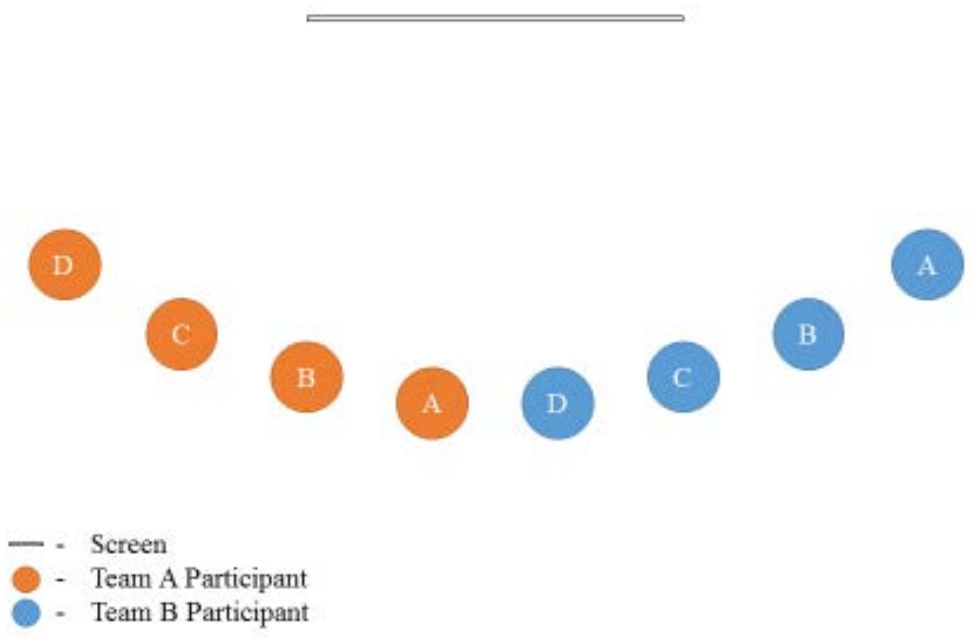

Figure 5.2. Diagram of The Laboratory Depicting The Position of Stations and Screen Used to Display Scores During The Team Competitions

Reward Conditions

No reward condition. In the no reward condition, there was no reward given to the winning team.

High reward interdependent condition. In the high reward interdependent condition, the amount of reward that a participant could earn relied on his/her performance compared with his/her teammates. If he/she performed better than his/her teammates, he/she was given more reward than his/her teammates. In the current study, a total reward of £15 was given to the team which won the competition. The participant who got the highest score in the winning team received 53.3% of the reward (£8), the second highest received 26.7% (£4), the third highest received 13.3% (£2), and the 4th highest received 6.7% (£1).

Low reward interdependent condition. In the low reward interdependent condition, the amount of reward that a participant could earn was not dependent on his/her performance, which meant that no matter how well or how bad he/she performed, he/she earned the same amount of reward as his/her teammate. In other words, the reward was distributed equally to the four participants of the winning team (25% each, £3.75).

Procedure

Participants attended a 1-hour testing session in a single-sex group of eight individuals. Each participant was assigned to an experimenter at one of the eight stations, arranged in a bow shape along one side of the laboratory, where they would then be asked to do a MVC test. Each participant was asked to be seated, held the handgrip dynamometer using their dominant hand, and put the underside of the handgrip dynamometer on their leg. Then they were asked to complete three maximal contractions, separated by one minute of rest (Cooke2011, 2013). After three

contractions, if the participant's second-highest contraction was within 5% of the highest one, the computer program terminated and recorded the highest force as the maximal voluntary contraction (MVC). However, if the participant's second-highest contraction was out of the 5% range of the highest one, the computer program continued and the participant was asked to do extra contractions until this requirement was met.

After the MVC was obtained, participants were asked to complete a baseline test, in which they were required to score as high total % MVC as possible in 3 minutes. The results from the baseline test were then ranked and used to assign participants into one of two teams for the competitive conditions. Team A was consisted of the participants who ranked 1st, 4th, 5th, and 8th from the baseline test, while team B consisted of the participants who ranked 2nd, 3rd, 6th and 7th. Participants were not told about the ranking of their baseline assessments, and the data from the baseline test was not analysed in the current study. This design feature was to balance the average effort-based ability level across the two teams, thereby ensuring the competitions could be close and fair.

Following this reassignment, a 5-minute rest was taken. During the rest period, both teams were informed that they would compete against each other for 3 minutes in three different competitive conditions: no reward competition, high reward interdependent competition, and low reward interdependent competition. Participants completed these three conditions in a counterbalanced order. The teams were told their aim was to generate a higher total % MVC than their opponents. They were also told that they were not allowed to move the handgrip off their leg, use both hands, switch hands, or use other part of body to squeeze the handgrip dynamometer.

The method of distributing the reward for the upcoming competition was explained to both teams. Participants were told that there would or would not be a £15 reward given to the winning team in the following competition, and the reward was distributed either equally (low reward interdependently) or extremely (high reward interdependently) to the four participants of the winning team. They were also informed that the total cumulative % MVC would be used to measure their team's performance.

After each competition, there was a 5 minute recovery period, during which participants completed the self-report measures to assess how they felt regarding the previous task. This sequence (i.e. rest, instruction, task, rest) was repeated until all three competitive conditions had been completed. At the end of the experiment, participants were thanked, debriefed, and asked not to disclose information about the experiment to others.

Statistical Analysis

A series of ANOVAs (3 Reward Conditions: no reward, high reward interdependent and low reward interdependent) was conducted on the outcome variables (performance, emotion, and effort). Post hoc tests were used to explore significant effects between two reward conditions. Partial eta-squared is reported as a measure of effect size. Values of 0.02, 0.13 and 0.26 indicate small, medium and large effect sizes, respectively (Cohen, 1992). Finally, Judd, Kenny, and McClelland's (2001) difference/sum regression procedure were used to test within-subjects mediation and moderation of the effects of the manipulations on performance.

Results

Task Ratings

The ratings associated with each reward condition are presented in Table 5.1. The ANOVA (3 Reward Conditions) revealed significant effects for competitive, cooperative, difficult, engaging, important and cohesive ratings. Post hoc analysis indicated that participants found both the low reward interdependent competition and the high reward interdependent competition more competitive, cooperative, difficult, important and cohesive than the no reward competition. The high reward interdependent competition was considered to be more engaging than the other two conditions.

Table 5.1

Task Rating across Reward Condition

	No Reward Competition		Reward Interdependent Competition		Reward Independent Competition				
Rating	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (2, 342)	*p*	η^2
Competitive	4.19	1.61	4.49[a]	1.51	4.50[a]	1.36	3.09	.05	.02
Cooperative	3.51	1.49	3.78[a]	1.43	3.90[a]	1.45	6.71	.01	.03
Difficult	4.06	1.54	4.53[a]	1.42	4.39[a]	1.31	8.22	<.001	.05
Engaging	3.51	1.45	3.85[a]	1.51	3.74	1.44	3.97	.02	.02
Important	3.04	1.62	3.45[a]	1.76	3.44[a]	1.65	5.60	<.01	.03
Cohesive	3.06	1.46	3.31[a]	1.45	3.33[a]	1.45	3.24	.04	.02
Conflict-Ridden	2.10	1.65	2.35	1.81	2.30	1.85	2.28	.10	.01

Note. a denote significant differences from no reward competition

Performance

The ANOVA (3 Reward Conditions) yielded a main effect of reward condition on the Total % MVC, F (2, 342) = 12.12, $p < .001$, $\eta^2 = .07$. Post hoc t-tests found that performance was worse in the no reward competition than the high reward interdependent competition, t (171) = 4.45, $p < .001$, and the low reward interdependent competition, t (171) = 3.12, $p < .01$. The difference between the high reward interdependent competition and the low reward interdependent competition was marginal, t (171) = 1.78, $p = .08$ (see Figure 5.3).

Figure 5.1. Total % MVC across Reward Conditions. Error bars depict standard error of the means

Pressure, perceived competence, enjoyment and self-reported effort

The ANOVA (3 Reward Conditions) yielded a main effect of reward condition on self-reported effort (see Table 5.2). Post hoc t-tests showed that compared to the no reward competition, participants felt they put more effort into the task under the high reward interdependent competition. Moreover, the main effect on pressure was significant, and the t-tests showed that participants felt more pressure in the high reward interdependent competition than the no reward competition.

Table 5.2

Effects of Task Condition on Pressure, Perceived Competence, Enjoyment and Self-Reported Effort

	No Reward Competition		High Reward Interdependent Competition		Low Reward Interdependent Competition				
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (2, 342)	*p*	η^2
Pressure	3.54	1.28	3.76[a]	1.32	3.68	1.31	2.84	.05	.02
Enjoyment	3.60	1.19	3.73	1.24	3.71	1.22	1.54	.22	.01
Competence	3.46	1.46	3.50	1.49	3.49	1.44	.13	.88	.001
Self-reported Effort	4.64	1.66	4.95[a]	1.56	4.79	1.59	3.91	<.05	.02

Note. a denote significant differences from no reward competition

Emotions

A series of ANOVAs (3 Reward Conditions) showed that there were no main effects of reward conditions on emotions towards opponents; while significant effects were observed on both positive emotions, e.g. pride, happiness and enjoyment, and negative emotions, e.g. embarrassment, guilt, and disappointment, towards teammates (see Table 5.3). Post hoc *t*-tests showed that except for feeling more guilt in the high reward interdependent condition, $t\ (171) = 2.74$, $p < .01$, participants experienced similar emotions in the no reward condition and the high reward interdependent condition. Despite this, compared to the no reward condition, participants experienced significantly more positive emotions in the low reward interdependent condition, such as pride, $t\ (171) = 2.30$, $p < .05$, happiness, $t\ (171) = 2.81$, $p < .01$, enjoyment, $t\ (171) = 3.88$, $p < .001$, wonderment, $t\ (171) = 3.02$, $p < .01$, and relief, $t\ (171) = 2.08$, $p < .05$; while participants experienced significantly less negative emotions, such as jealousy, $t\ (171) = 2.25$, $p < .05$, and anger, $t\ (171) = 2.56$, $p < .05$. Furthermore, compared to the high reward interdependent condition, participants also felt more positive and less negative emotions in the low reward interdependent condition. Specifically, they reported feeling more pride, $t\ (171) = 2.29$, $p < .05$, enjoyment, $t\ (171) = 3.64$, $p < .001$, wonderment, $t\ (171) = 2.96$, $p < .01$, and relief, $t\ (171) = 2.07$, $p < .05$, as well as less worry, $t\ (171) = -2.05$, $p < .05$, embarrassment, $t\ (171) = 2.62$, $p < .05$, guilt, $t\ (171) = 3.35$, $p < .01$, disappointment, $t\ (171) = 2.52$, $p < .05$, jealousy, $t\ (171) = 3.27$, $p < .01$, and anger, $t\ (171) = 2.18$, $p < .05$.

Table 5.3

Emotion Towards Teammates across Reward Condition

	No Reward Competition		High Reward Interdependent Competition		Low Reward Interdependent Competition				
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F* (2, 342)	*p*	η^2
Interest	3.15	1.20	3.17	1.27	3.15	1.23	.03	.97	.00
Amusement	3.14	1.30	3.04	1.30	3.13	1.27	.73	.48	.00
Pride	2.86	1.31	2.87	1.37	3.08[ab]	1.30	3.18	<.05	.02
Happiness	2.88	1.31	3.01	1.30	3.15[ab]	1.32	4.22	<.05	.02
Enjoyment	2.80	1.23	2.82	1.29	3.15[ab]	1.23	9.17	<.001	.05
Tenderness	1.96	1.13	1.95	1.12	2.02	1.21	.56	.57	.00
Wonderment	1.88	1.03	1.90	1.07	2.12[ab]	1.17	5.82	<.01	.03
Relief	2.10	1.20	2.12	1.24	2.28[a]	1.26	2.91	.06	.02
Astonishment	2.03	1.20	2.04	1.12	2.14	1.22	.86	.42	.01
Longing	1.52	0.91	1.52	0.89	1.60	0.97	.93	.40	.01
Pity	1.51	0.82	1.53	0.85	1.48	0.85	.35	.70	.00
Sadness	1.51	0.86	1.58	0.94	1.45	0.83	2.14	.12	.01
Worry	1.47	0.76	1.56	0.83	1.44[b]	0.77	2.38	.10	.01
Embarrassment	1.62	0.94	1.69	0.96	1.52[b]	0.83	3.51	<.05	.02
Guilt	1.45	0.74	1.62[a]	0.89	1.41[b]	0.72	6.93	.00	.04
Disappointment	1.66	0.94	1.80	1.09	1.60[b]	0.91	3.42	<.05	.02
Jealousy	1.53	0.81	1.60	0.91	1.40[ab]	0.77	5.61	<.01	.03
Disgust	1.45	0.83	1.44	0.81	1.39	0.77	.52	.59	.00
Contempt	1.53	0.90	1.50	0.89	1.46	0.84	.61	.54	.00
Anger	1.72	1.08	1.70	1.02	1.53[ab]	0.88	3.62	<.05	.02

Note. a and b denote significant differences from no reward competition and high reward interdependent competition, respectively.

Mediators of the Effects of Reward Condition on Performance

The analyses reported above indicated that performance increased from the no reward competition to both the high reward interdependent competition and the low reward interdependent competition. To further test whether each potential mediator/moderator predicts the difference in performance, I used Judd, Kenny, & McClelland, 's (2001) method to test mediation in a within-subject design. To conduct these analyses, there must be significant difference across conditions in the dependent variable (%MVC) and potential mediator/moderator variables. More specifically, I regressed the difference of the total % MVC on the difference and the sum of significantly correlated variables, e.g. self-reported effort, pride, happiness, and wonderment. Mediation can be inferred if the difference in effort and emotion predicts the difference in performance. If the sum predicts the difference in %MVC, there is evidence for moderation.

When the total % MVC difference (M_D) between the high reward interdependent condition and the no reward condition was regressed on the pressure sum (P_S) and difference (P_D), the following estimate results were obtained:, M_D = 863.82 + 260.90P_D - 64.63P_S. In this model, the difference in pressure mediated the difference in total % MVC, t (169) = 3.23, $p < .01$, whereas the pressure sum was not significant ($p = .13$). Moreover, the analysis revealed that the difference in the self-reported effort (E_D), t (169) = 4.78, $p < .001$, and the sum in the self-reported effort (E_S), t (169) = 2.60, $p < .05$, were both significant to the difference on the total % MVC, M_D = 1181.29 + 292.03E_D – 85.78E_S. The residual differences in the total % MVC were still significant in these regressions (ps < .01). Therefore, self-reported effort and pressure partially mediated the increase in the total % MVC from the no reward condition to the high reward interdependent condition. Self-reported effort and

pressure also served as moderators of the change in performance, where more self-reported effort and pressure were respectively associated with a greater improvement in performance from no reward condition to the high reward interdependent condition.

In addition, regressing the difference (PR_D) and the sum (PR_S) in pride on the total % MVC difference between the low reward interdependent condition and the no reward condition yielded the following estimate results, $M_D = 859.07 + 208.26PR_D - 100.16PR_S$. In this model, both the difference in pride, t (169) = 2.65, $p < .01$, and the sum in pride, t (169) = 2.40, $p < .05$, significantly mediated the difference in the total % MVC. Similar results were found when regressing the difference in happiness (H_D), and the sum of happiness (H_S) on the total % MVC, $M_D = 845.85 + 165.57H_D - 96.79H_S$. Both the difference in happiness, t (168) = 2.12, $p < .05$, and the sum of happiness (H_S), t (168) = 2.29, $p < .05$, were significantly mediated the difference on the total % MVC. The residual differences in the total % MVC were still significant in these regressions (ps < .01). Hence pride and happiness partially mediated the improvement in the total % MVC from the no reward condition to the low reward interdependent condition. These two positive emotions also served as moderators to the promotion on performance, where more pride and happiness towards teammates were associated with a larger improvement from no reward condition to the low reward interdependent condition. Moreover, the difference in wonderment (W_D), t (169) = 2.57, $p < .05$, and the difference in relief (R_D), t (169) = 2.32, $p < .05$ also predicted the difference in the total % MVC between the no reward condition and the low reward interdependent condition respectively. However, the sum in wonderment (W_S) and the sum in relief (R_S) did not significantly predict the total % MVC difference respectively (ps > .05). The residual differences in the total % MVC were also significant in these regressions (ps < .01). These regression models for

wonderment, $M_D = 647.09 + 250.39W_D - 99.00W_S$, and for relief, $M_D = 615.14 + 193.32R_D - 77.97R_S$, suggested that wonderment and relief partially mediated the difference in the total % MVC between the no reward condition and the low reward interdependent condition.

Mediators of the Effects of Reward Condition on Self-Reported Effort

The ANOVAs reported above indicated that self-reported effort increased from the no reward condition to the high reward interdependent condition. To further test whether the difference in self-reported effort was predicted by other potential mediators, a set of mediation analyses were conducted in the same way as described above. When difference in self-reported effort (E_D) between the high reward interdependent condition and the no reward condition was regressed on the pressure sum (P_S) and difference (P_D), the following estimate results were obtained:, $E_D = 0.53 + 0.65P_D - 0.05P_S$. In this model, the difference in pressure predicted the difference in self-reported effort, $t\ (169) = 7.87$, $p < .001$, whereas the pressure sum was not significant ($p = .26$). The residual differences in self-reported effort was not significant ($p = .12$), indicating that pressure was fully mediated the increase in self-reported effort from no reward condition to the high reward interdependent condition.

Discussion

The Effects of Reward Interdependence on Performance

The first aim of this study was to investigate the effects of high reward interdependence on effort-based performance, emotions, and self-reported effort in a low task interdependent situation.

The results showed that compared to the no reward condition, the performance was significantly better under both high reward interdependent condition and low reward interdependent condition. Participants also found the competition with both

high and low reward interdependence were more competitive, cooperative, difficult, important and cohesive than the no reward competition. It seems that reward interdependence changed individual's perception on the upcoming competition. These findings are supported by many studies (e.g. DeMatteo, Eby, & Sundstrom, 1998; Shamir, 1990; Shaw, Duffy, & Stark, 2001), which stated that team-based rewards had positive effects on collective motivation and behaviours to the success of the group. Slavin (1980) argued that the benefits of cooperation within the group would be greatest when presented in conjunction with an external contingency such as reward. It might lead participants to place more emphasis on performing at a higher level, which resulted in an increased achievement (Johnson, 1999).

Despite this, the increase on performance from the low reward interdependent condition to the high reward interdependent condition was at the margin of statistical significance. It was contrary to the previous findings (see Chapter 4 in this thesis), in which the low reward interdependence had greater effects than the high reward interdependence on effort-based performance (i.e. the number of baskets attempted). DeMatteo et al., (1998) stated that low reward interdependence was more likely to foster cooperative behaviour and team cohesion while the high reward interdependence was likely to promote team productivity. Shamir (1990) also argued that the greater levels of motivation and effort on the part of each team member's task might result in the greater level of productivity. It seemed that effort and cooperative behaviour were two distinct processes of the influence in team performance. This might explain the reason why the results of the current study was contrary to the previous findings. Because the task interdependence was high in previous study, and the high task interdependence has shown positive effects on encouraging collaboration within the team (Courtright et al., 2015). Therefore, it seems that the

increased number of baskets attempted in previous study (see Chapter 4 in this thesis) was more associated with increased cooperation behaviour as participants needed to rebound more for their partners. Whereas the increased total % MVC in the current study was more associated with a higher level of effort.

In the current study, a minimum level of skills was required to complete the task. Therefore, all the participants were believed to be able to increase their performance by contributing more effort into the task. In Wageman and Baker's (1997) copy editing study, no difference was observed on cooperative behaviour between different level of reward interdependence, while the performance was significantly better under the high reward interdependent condition. Similar to the current study, all the participants were able to complete the task with the required level of skills due to the training they received before the task. Therefore the average skill level was no longer a limitation of the promotion effects of the high reward interdependence on performance. As a result, it seems that the amount of effort that participants contributed to the task played a crucial role on the effects of reward interdependence on performance.

The Effects of Reward Interdependence on Self-Reported Effort

The amount of self-reported effort was found higher in the high and low reward interdependent condition, however, the difference was only found to be significant between the high reward interdependent condition and no reward condition. It might be because, compared to the low reward interdependent condition, participants had an opportunity to achieve a bigger reward under the high reward interdependent condition, which made the competition more engaging, and motivated participants to exert additional effort into the competition. DeMatteo et al., (1998) concluded that reward size was correlated with motivation, and the higher level of

reward interdependence was associated with higher motivation and performance improvement. In the current study, the improvement in effort-based performance was more directly reflected by the increase in self-reported effort.

In addition, compared to the no reward condition, participants felt significantly more pressure under the high reward interdependent condition. According to the processing efficiency theory (Eysenck & Calvo, 1992), increased pressure might encourage participants to contribute more effort to the task to minimize the detrimental effects of the anxiety state. Cooke, Kavussanu, McIntyre, and Ring (2013) also reported that enhanced effort was associated with increased anxiety between different types of competitions. Despite these, Wageman and Baker (1997) stated that people put more effort into the task might be because they simply enjoyed the task more. This argument was supported by Cooke et al., (2013), who found that increased enjoyment partially mediated the increase in self-reported effort. They suggested both enjoyment-based and anxiety-based mechanism play a role in the effects of different types of competition on performance. In line with their statement, emotions might play an important role in explaining the changes in performance and self-reported effort among different types of competitions with different reward condition.

The Effects of Reward Interdependence on Emotions

Compared to the no reward condition and the high reward interdependent condition, participants reported feeling more positive and less negative under the low reward interdependent condition. Moreover, participants felt the most negative under the high reward interdependent condition as they felt more guilt and had no difference on other emotions when compared to no reward condition. It seems that the high reward interdependence and the low reward interdependence had opposite effects on emotions.

My findings suggested that low reward interdependence might create a more cooperative team environment than the high reward interdependence, and a less competitive team environment than no reward condition. It was supported by DeMatteo et al., (1998), who argued that the low reward interdependence was more likely to promote group solidarity than the high reward interdependence, which was associated with more positive and less negative feelings towards teammates.

It might be because when the reward interdependence was low, the reward that each one can get was the same. In this circumstance, the importance of maintaining solidarity or cohesion within the team might be crucial for team members (Deutsch, 1949). In contrast, this importance might be less considered by team members under the high reward independent condition. Because the reward was distributed depends on the performance, team members might focus more on achieving higher performance rather than maintaining harmony within the team. As a result, people felt more worried, embarrassment, guilt, disappointment, jealousy and anger towards their teammates, while the positive effects of reward on emotions, e.g. more pride, enjoyment, wonderment, and relief, were all disappeared.

In summary, people performed better when there was a team reward involved in the task, and the improvement in performance was highly dependent on the level of reward interdependence. Participants performed best with the highest level of pressure and self-reported effort, and worst feelings when the reward interdependence was high. The low reward interdependence had the most positive effects on emotions and also increased effort-based performance without a significantly higher level of self-report effort. It seems that the low reward interdependence made people use their efforts more efficient, while the high reward interdependence made people push themselves to perform at the maximum level. In practice, the balance between team

achievement and team solidary might need to be taken into consideration when introducing reward interdependence into a task to promote team performance, especially for a long term task. It was expected that the promoting effect of the high reward interdependence on performance might be reduced due to the negative team environment if the task lasts for a long time. Future studies might need to investigate the long term effects of different level of reward interdependence in a multiple sessions task.

Mechanisms Underlying Performance

The second aim of this study was to find the mechanism underlying performance by assessing the mediating roles of emotions, self-reported effort on performance and the mediating roles of emotions on self-reported effort. The analysis suggested that people's performance was influenced by the high reward interdependence and the low reward interdependence under different mechanisms.

The results indicated that self-reported effort and pressure partially mediated the increase in the total % MVC from the no reward condition to the high reward interdependent condition. Self-reported effort and pressure also served as moderators of the change in performance, where more self-reported effort and pressure were respectively associated with a greater improvement in performance from no reward condition to the high reward interdependent condition. In addition, pressure was found fully mediated the increase in self-reported effort from no reward condition to the high reward interdependent condition. My findings were supported by the processing efficiency theory (Eysenck & Calvo, 1992), in which increased pressure could increase anxiety, and increased anxiety might force people to put more effort into the task to minimize the aversive anxiety state (Cooke et al., 2013; Eysenck & Calvo, 1992; Eysenck et al., 2007). Because the task in the current study was effort based,

participants' performance was easy to be improved by contributing more effort. However, the mediating effect of self-reported effort and pressure on the performance difference was not observed between no reward condition and the low reward interdependent condition. It might be because when the reward interdependence was low, people did not feel as high level of pressure as the high reward interdependent condition, which prevented people from being motivated to allocate more effort to the task. Therefore, it seems that the low reward interdependence influenced performance through a different path without dramatically increasing effort.

The analysis showed that enjoyment, pride, wonderment and relief towards teammates all partially mediated the increase in the total % MVC from the no reward condition to the low reward interdependent condition. Enjoyment and pride also served as moderators of the change in performance, where more enjoyment and pride were respectively associated with a greater improvement in performance from no reward condition to the low reward interdependent condition. It was partially supported by the enjoyment-based mechanism (Cooke et al., 2013; Tauer & Harackiewicz, 2004), in which increased enjoyment reflected increased intrinsic motivation, which positively associated with performance through increasing effort. In the current study, the increased positive emotions created by the low reward interdependence might help people to translate their effort into performance with a higher efficiency. This was supported by Grawitch et al., (2003), who stated that positive group emotions were associated with enhanced implementation efficiency. Therefore, the low reward interdependence could lead to a better performance without significantly increasing effort. It also provided an alternative way of explaining the effects of positive emotions on performance.

Limitations and Future Directions

There are some limitations of this research that need to be considered when interpreting these findings. First, the experiment assessed mixed sex group participants. Kring and Gordon (1998) concluded that the personality difference between males and females would result in different reactions on emotions, which might lead to different effects on performance. Future studies could assess the effects of reward interdependence in a single sex setting to get a clearer understanding of the effects of different levels of reward interdependence on emotions, effort, and performance. Second, individual difference factors, such as individualism and collectivism, were not considered in the current study. DeMatteo et al., (1998) concluded that the number of individualists and collectivists in the team might be an important factor influencing the effects of team reward. Future studies could build teams with different personality manipulations to find out the role of personality on the effects of reward condition on performance. Finally, the reward might not have been big enough to create a competitive environment within and between groups, especially for the high reward interdependent condition. Future studies could create a more competitive task with a larger reward to get a clearer image of the mechanism behind the effect of the different levels of reward interdependence on outcome measures.

It would be interesting for future research to consider predictors of antisocial behaviour, such as ego and task orientation (e.g. Kavussanu, 2017). Although the reward in the current study was only £15 for a team to share on winning each competition, there was antisocial behaviour observed in the competition with reward involved, such as cheating. Moreover, future studies could further investigate the effects of positive emotions that are seldom studied such as pride, wonderment, and relief. Future studies could also obtain physiological measures, such as testosterone

(Neave & Wolfson, 2003), which could reduce perception of negative emotions and improve performance (Wood & Stanton, 2012). Finally, future studies could investigate the long term effects of different level of reward interdependence in a multiple sessions task. Yamagishi (1988) stated free-riding was a potential threat when people performed several trials of a task. Free-riding was likely to occur when participants who performed well perceived that they were carrying the weight of team members who performed poorly (e.g. DeMatteo et al., 1998), which could deduct the contribution of the team members who felt they were over-contributing. Therefore, it would be worth to test the effects of different level of reward interdependence in a task with multiple trails.

Conclusion

In conclusion, the current study provided evidence to indicate that low reward interdependence and high reward interdependence differentially improved effort-based performance. Specifically, increased self-reported effort and pressure mediated the improvement in performance when the reward interdependence was high, while increased enjoyment, pride, wonderment, and relief towards teammates mediated the improvement in performance when the reward interdependence was low. The findings supported the intrinsic motivation mechanisms (Tauer & Harackiewicz, 1999) and the processing efficiency theory (Eysenck & Calvo, 1992; Eysenck et al., 2007) to explain the difference in performance between different types of competition. Future research should continue to examine the effects of reward interdependence in a different effort-based activity to get a better understanding of the effects of reward interdependence on performance, and the mechanism behind it.

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Chapter 6: General Discussion

The aim of this thesis was to increase our understanding of the social psychology of competition. As such this thesis investigated the effects of certain kinds of interdependence that might induce the change in performance under competition. The purpose of this final chapter was to summarise the findings of each experiment and outline the theoretical and practical implications of the research. Finally, it will outline limitations for the current programme of study and suggestions for future research.

A Summary of Aims and Findings

The aim of the first experimental chapter was to investigate the effects of between-team resource interdependence on performance, emotions and goal-related perceptions in an effort-based individual competition. It also emphasised the importance of clarification of the type of competition in understanding the competition-performance relationship, and outlined the social interdependence theory which provided a framework to understand the structure of competition, the effects of different kinds of interdependence on performance, and the factors that might influence performance under competition, such as the type of task, emotion, and goal-related perceptions. The experiment in this chapter tested the effects of between-team resource interdependence in competition. The primary purpose was to examine whether resource interdependence could influence performance, and evaluate the possible associations among performance, emotions and goal-related perceptions. Results indicated that, compared to the resource independent condition, participants carried fewer balls to the container under resource interdependent condition. Apart from this there were no main effects of resource interdependence on emotions and

goal-related perceptions. These findings extended the understanding of the effects of social interdependence in explaining the change of performance in different situations. However, this study was conducted in an effort-based task in an individual competition. The effects of between-team resource interdependence might be distinct in a skill-based task in a team competition, in which people could learn and develop skills from others to improve their performance (Cooke, Kavussanu, McIntyre, & Ring, 2013; Stanne, Johnson, & Johnson, 1999).

Accordingly, to build on the findings in chapter two, the experiment reported in chapter three examined the effects of between-team resource interdependence in an effort and skill mixed task in a two-on-two team competition. By using a basketball shooting and rebounding task, the study was able to test the effects of resource interdependence on both effort-based performance, i.e. thes number of baskets attempted, and skill-based performance, i.e. shooting accuracy. Moreover, the effects of the fairness of competition was also examined in this study. Again, the main purpose of this study was to investigate the effects of between-team resource interdependence on performance, emotions and effort. Results of this study indicated that the number of baskets made, the number of baskets attempted and the shooting accuracy was higher in the resource independent competition compared to the means interdependent competition. The effects of fairness of competition were not observed on performance. Moreover, participants felt more positive and less negative after doing the task. However, there were no effects of resource interdependence on emotions and effort. These findings further improved our understanding of the effects of resource interdependence on performance. However, the effects of other types of interdependence, such as reward interdependence, has been not widely studied in sports competition.

To continue expanding the use of social interdependence theory in explaining the effects of competition on performance, the effects of reward interdependence was assessed in the experiment of chapter four. The experiment examined the effects of high reward interdependence and its interaction with between-team resource interdependence on performance, emotions and effort in the team competition. By using the basketball shooting and rebounding task, the amount of task interdependence was high, so that the interaction effects between task interdependence and reward interdependence can be observed (Moser & Wodzicki, 2007). Results indicated that there was no difference in performance between the high reward interdependent condition and the low reward interdependent condition. Compared to the low reward interdependent condition, participants felt less negative after doing the task under the high reward interdependent condition. Moreover, better effort-based performance (i.e. the number of baskets attempted) and effort and skill mixed performance (i.e. the number of baskets made) were found in resource independent condition, whereas there were no effects of resource interdependence observed on skill-based performance (i.e. shooting accuracy). Mediation analysis suggested self-reported effort fully mediated the improvement in the number of baskets attempted and the number of baskets made from the resource interdependent condition to the resource independent condition. Furthermore, interaction results were found between resource interdependence and reward interdependence. Specifically, compared to the high reward interdependent condition, the difference between the resource interdependent condition and resource independent condition in the number of baskets attempted was larger under the low reward interdependent condition. However, potential limitations of this experiment were acknowledged. For instance,

the reward might be too small, and each individual's skill level was not accurately assessed.

To address some of these limitations, the experiment in chapter five examined the effects of reward interdependence on performance, emotions, and self-reported effort in an effort-based task in a four-on-four team competition. By using a handgrip task in a low task interdependent condition, the level of skills that required to complete the task was minimized. Results showed that compared to the no reward condition, the performance was significantly better under both high reward interdependent condition and low reward interdependent condition. The increase in performance from the low reward interdependent condition to the high reward interdependent condition was at the margin of statistical significance. Moreover, compared to the no reward condition and the high reward interdependent condition, participants reported feeling more positive and less negative under the low reward interdependent condition. Also, participants felt the most negative under the high reward interdependent condition as they felt more guilt and had no difference on other emotions when compared to the no reward condition. The amount of self-reported effort was found higher in the high and low reward interdependent condition, however, the difference was only found to be significant between the high reward interdependent condition and no reward condition. The mediation analysis indicated that self-reported effort and pressure partially mediated the increase in the total % MVC from the no reward condition to the high reward interdependent condition, whereas enjoyment, pride, wonderment and relief towards teammates all partially mediated the increase in the total % MVC from the no reward condition to the low reward interdependent condition. These findings further supported the use of social

interdependence theory on clarifying and understanding the effects of different types of competition on motor performance.

In summary, there are many common results and discrepancies across these studies. Specifically, studies in chapter two, three and four all reported a negative effect of between-team resource interdependence on effort-based performance in both individual and team competition. The negative effect of between-team resource interdependence on skill-based performance was only found in the second study, whereas there was no effects found in the third study, which might be due to the interaction between resource independence and reward interdependence. Apart from that, the effort-based performance was better in the high reward interdependent condition in the study of chapter five, whereas the effort-based performance was worse in the high reward interdependent condition in the study of chapter four. It might be because of the effects of different level of task interdependence. These discrepancies across these findings will be further discussed in the following sections.

Theoretical Implications

Resource Interdependence

Findings from the experiments described in chapter two, three, and four serve to highlight the importance of between-team resource interdependence in the competition-performance relationship and the potential of using social interdependence theory as a classification of various kinds of competition. Because the competition with different types of resource interdependence have different effects on motor performance, the type of interdependence that exists in the competition can be used to clarify the type of competition.

The results from the second study revealed the negative effects of between-team resource interdependence on effort-based performance (i.e. the number of balls

carried to the container, the number of baskets attempted and the number of baskets made), and the detrimental effects of between-team resource interdependence on skill-based performance (i.e. shooting accuracy) was stronger in people with low-level of skills. These results further identify the differences between tasks with and without between-team resource interdependence by finding out the various effects on performance and raise the importance of individual's skill level in the effects of different types of competition on skill-based motor performance. Also, these findings suggested that the effects of a same type of interdependence might be different between teams and within teams, which highlights the importance of considering the effects of between-team interdependence and within-team interdependence separately. Hence, both between-team interdependence and within-team interdependence should be considered when clarifying the type of a competition.

In addition, although task types have been viewed as an influential factor in the performance-competition relationship (Hackman & Morris, 1975; Stanne et al., 1999). The present findings suggested that the performance types, which indicated whether the performance was effort-based, skill-based or mixed, might be more accurate to use when interpreting the effects of competition. Because there could be both effort-based and skill-based performance in a skill-based task, and the mechanism behind the effects of the same competition on effort-based and skill-based performance might be different.

Mediation effects were only found in the experiment described in chapter four. Specifically, the increased self-reported effort fully mediated the improvement in the number of baskets attempted and the number of baskets made from the resource interdependent condition to the resource independent condition. It supports the intrinsic motivation mechanism on explaining the effects of resource interdependence

on performance (Tauer & Harackiewicz, 2004). However, the significant difference on self-reported effort between resource independent condition and resource interdependent condition the mediation effects were not found in the experiments of chapter two and three. It seems that the use of team-based reward might promote the benefits of cooperation within the group through a positive effect on collective motivation (Slavin, 1980), which motivated participants to engage more into the task. This effect was larger under resource independent condition. These findings provided new insight into the negative effects of resource interdependence on attention control, which could impair the learning process and the effort allocated to the task (Fan & Gruenfeld, 1998).

Reward Interdependence

Findings from the experiments described in chapter four and five highlight the importance of within team reward interdependence in the competition-performance relationship and a possible way to use social interdependence theory as a classification of various kinds of competition. Because the competition would have different effects on motor performance with different types of reward interdependence, the competition can be clarified by the type of interdependence that exists in it.

The results from the experiment described in chapter five showed a close to significant improvement in effort-based performance (i.e. the total % MVC) from the low reward interdependence competition to the high reward interdependence competition. By identifying the different effects of high and low reward interdependence on effort-based motor performance, this finding extended the use of reward interdependence on clarifying different types of competition. However, the experiment of chapter four showed no main effects of reward interdependence on

performance, but an interaction effect between resource interdependence and reward interdependence was found. Compared to the high reward interdependence condition, participants' effort-based performance was better in the resource independent competition under the low reward interdependent condition. It suggested that task interdependence might play an important role on determining the direction of the effects of reward interdependence. Specifically, when the task interdependence was low, the effects of reward interdependence was more focused on improving individual effort, whereas when the task interdependence was high, the effects of reward interdependence was more likely to foster cooperative behaviour (DeMatteo, Eby, & Sundstrom, 1998; Shamir, 1990). These findings highlight the interactive effects among resource interdependence, reward interdependence and task interdependence, and increase the appropriateness of using social interdependence theory to classify different types competition.

In addition, the results from the experiment of chapter five showed that the increased enjoyment, pride, wonderment and relief towards teammates all partially mediated the increase in the total % MVC from the no reward condition to the low reward interdependent condition, which was consist with the enjoyment-based mechanism (Cooke et al., 2013; Tauer & Harackiewicz, 2004). The increased self-reported effort and pressure partially mediated the increase in the total % MVC from the no reward condition to the high reward interdependent condition, which could be explained by processing efficiency theory (Eysenck & Calvo, 1992). It seems that different levels of reward interdependence influenced motor performance through different mechanisms, which highlights the role of different level of reward interdependence on classifying different types of competition.

Summary

In sum, by testing the effects of certain types of interdependence on motor performance, emotions and effort in competition, this thesis adds to the literature on social interdependence theory by identifying the effects and interaction effects of certain kinds of interdependence that have seldom been looked at, and extends the knowledge of how to construct competition by social interdependence theory (Johnson & Johnson, 2005). Moreover, the reported results also highlight some mechanisms behind the effects of competition on effort-based and skill-based performance, and the different mechanisms for the effects of individual and team competition. All in all, these results provide good support for using social interdependence theory to classify competition and propose that future research should classify competition by three mains factors: the task is completed by individual or team, the outcome variable is effort-based, skill-based or mixed, and the type and level of interdependence that exist in the task. It is hoped that with a clearer classification of competition, researchers could fit the diverse theories and mechanisms that explains the competition-performance relationship into a specific type of competition, which would lead to a better understanding of the nature of competition and its effects on motor performance.

Practical Implications

The present findings have implications for the design and organization of tasks in a sports environment. Specifically, because of the detrimental effects of between-team resource interdependence on learning progress, it is suggested that when organizing a task for people with low level of skills, if the task is skill-based, the task should be resource independent, which should help people promote their skills and improve their performance more efficiently. Moreover, when designing an effort-based task for a group of people who are required to put more effort into the task,

such as a training program for people who are overweight and have chronic disease, the task should be low task interdependence and people could be beneficial more on contributing more effort into the task if the within-team reward interdependence is high (DeMatteo et al., 1998; Shamir, 1990). In contrast, when designing an effort-based task for people who are required to build a better team environment within the team, such as a training session for a team with some new players, the task should have high task interdependence and the within team reward interdependence should be low to promote the helping behaviour and interpersonal liking (Courtright et al., 2015; Johnson & Johnson, 2005).

In addition, by identifying the type of level of the three main factors in the competition, the possible influence factor on performance, such as positive emotions, pressure and self-reported effort, and the direction of the influence can be predicted before the competition. Therefore coaches could use a suitable intervention to help athletes to maintain a relatively high level of performance, recover from a poor performance or reach a greater level of performance.

Limitations of the Research

Some of the limitations of the current research, such as the reward might not have been big enough to create a competitive environment within and between groups, the experiments assessed mixed sex group participants who did not consider the personality difference between males and females, and the lack of consideration of individual difference factors, were presented in the discussions of the experimental chapters. However, there are two limitations that have not been previously acknowledged.

First, over 90% of the participants recruited in the reported experiments were sports students who were expected to be more competitive. Because of the known

different reaction under competition in different groups of people (e.g. Sim & Kim, 2010) it could limit the use of the findings that stated above in other group of people, such as people who are not physically active and sports experts who have been involved in top-level of sports competition for years. Future studies could retest the study in chapter three, four and five in different groups of people to confirm whether the effects are the same across a diverse group of people.

Second, except for the performance measures, the experiments reported above only used self-reported measures on other outcome variables, such as emotions and self-reported effort. To reduce some of the concerns that related to these measurements (e.g. Organ & Podsakoff, 1986), the experiments reported in this thesis generally adopted measures that had been shown to have good reliability and had been used previously in competitive settings (e.g., the Sport Emotion Questionnaire, the Geneva Emotion Wheel, the Intrinsic Motivation Inventory). However, there might be measurement issues by only using self-reported measures (Sallis & Saelens, 2000). Therefore, future studies could add physiological measurements during the task to get a more detailed insight into the relationship between these outcome variables and performance.

Directions for Future Research

Some suggestions for future research have already been presented in each experimental chapter and the preceding discussion. The purpose of this section is to present a brief overview of some key research directions that seem worthy of exploring.

First, future studies could further explore the effects of different types of interdependence and the interaction between different types of interdependence on motor performance in competition. Although social interdependence theory has been

studied for over 60 years, no studies have included the relations among interdependence, interaction patterns, and outcomes in the same study (Johnson & Johnson, 2005). Moreover, there has been little attention paid to the effects of boundary interdependence on motor performance. Boundary interdependence is common in team sports, it could exist after the players are traded, between home and away matches, and the like. Furthermore, the effects of social interdependence on experts' motor performance should be tested, who have shown a different reaction to pressure under competition (e.g. Sim & Kim, 2010).

Second, future studies could test the method of classification proposed in the current study by doing a meta-analysis and classifying each study in the analysis by the three main factors stated above. It is hoped that by doing such a review, either this thesis's method of classifying competition can be further supported by more evidence, or there will be more factors added to the current method and construct a new method for classifying different types of competition. In any case, it is believed to be beneficial for a better understanding of the nature of competition.

Third, future studies could use virtual reality techniques to simulate an environment that more closely resembles a real match. It is hoped that, by using virtual reality, participants can involve and engage in the experiment more, which should lead to a more accurate result to the real competition. It should help researchers to obtain more direct information from participants and take a deeper insight into people's real response in the competition.

Conclusion

Despite our knowledge of the effects of competition on motor performance, little was known about the detailed classification of different types of competition. Accordingly, this thesis set out to advance our knowledge of using social

interdependence theory to clarify different types of competition. By testing the effects of between-team resource interdependence and within-team reward interdependence in skill-based and effort-based performance in the team competition, the results further demonstrate the effects of different types of interdependence on motor performance and explore the possible relationship among emotions, effort and performance. Due to the complexity of competition, there are still many unknown factors that influence the effects of competition and should be considered to systematically classify different types of competition. However, by identifying the types of interdependence in the competition and further exploring the effects of different types of interdependence, it is hoped that the current thesis has gone some way to improve our understanding of this complex social climate, which should be helpful for individuals to be motivated to involve and maintain a high-performance level.

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Appendices

1. Questionnaires

1A) Visual Analog Scale for Emotions and Goal-related Perceptions

Below you will find a list of questions that describe a range of feelings and thoughts that sport performers may experience. Please read each one carefully and draw a mark to cross each line on the scale below each question how you feel or think **right now, at this moment, in relation to the *upcoming competition.***

How important for you to win the competition?

Not at all ---------- extremely

How likely do you think you can win the competition?

Not at all ---------- extremely

How demanding do you expect the competition to be?

Not at all ---------- extremely

How able are you to cope with the competition?

Not at all ---------- extremely

How worried are you feeling?

Not at all ---------- extremely

Below you will find a list of questions that describe a range of feelings that sport performers may experience. Please read each one carefully and draw a mark to cross each line below each question how you feel or think **right now, at this moment, in relation to the *past 3 minutes.***

How much effort did you put in the competition?

Not at all ---------- extremely

Did you enjoy the competition?

Not at all ---------- extremely

Did you feel awkward because of your opponent, and want to quit the competition?

Not at all ---------- extremely

Did you feel angry with your opponent?

Not at all ---------- extremely